More than 25,000 Copies per Week
APR 4 1921

Electrical World

McGraw-Hill Company, Inc. New York, April 2, 1921 Twenty-five Cents a Copy

Since 1893, when the first Fibre Conduit — Orangeburg — was placed on the market, light and power companies, telephone and telegraph companies, street railway and railroad companies, in all parts of the country, have used it continually.

Whoever buys Orangeburg once, buys again. The high quality of the first fibre conduit has never changed and is unchanging.

Engineers are convinced of its unvarying quality.

Watch for next week's issue.

The FIBRE CONDUIT CO.
Orangeburg, New York

ORANGEBURG FIBRE CONDUIT

Unvarying Efficiency

Weston
Model 280

Miniature Precision Instruments

are of the permanent magnet, movable coil type and are of such size that they will slip into the coat pocket, thus making an ideal instrument for the inspector. Though small in size, these instruments possess all of the characteristics of the well-known larger Weston Portable Instruments.

The guaranteed accuracy of these instruments is 1 per cent of full scale value.

The cases of sheet steel protect against stray fields.

These instruments are made as single-range Millivoltmeters and Milliammeters, and as single-, double- and triple-range Ammeters, Voltmeters and Voltammeters.

Write for Bulletin 501 which gives complete information

Weston Electrical Instrument Company
13 Weston Ave., Newark, N. J.

Branches in the Principal Cities throughout the World

New York
Chicago
Philadelphia
Boston
Cleveland
Detroit
St. Louis
San Francisco
Denver
Cincinnati
Pittsburgh
Richmond

Model 280 Miniature Precision Voltammeter, triple-range

Buffalo
Minneapolis
New Orleans
Jacksonville
Seattle
Toronto
Montreal
Halifax
Winnipeg
Vancouver
Calgary, Alta.

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician
Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR., Editor D. H. BRAYMER, Managing Editor
S. B. WILLIAMS, Assistant Managing Editor A. M. PERRY, Engineering Editor J. C. MARTIN, Western Editor G. E. ARMSTRONG, Pacific Coast Editor H. S. KNOWLTON, New England Editor
Associate Editors: P. S. BIEGLER C. T. BALDWIN R. H. BACON
T. P. KINDIG R. M. DAVIS E. H. HUBERT F. C. WELLS

Volume 77 New York, Saturday, April 2, 1921 *Number* 14

Time to Give Consideration to Coal Supply

THIS is usually the season of the year when dealers offer some slight encouragement to householders to purchase their year's supply of coal. So far no inducements have been forthcoming to the large electric light and power companies in the shape of preferential freight rates to cause them to purchase an abnormal supply of coal at this time and store a large part of it. Unless some such proffer is made, however, there is no incentive to store much coal, because storage means rehandling, deterioration and added expense. All prudent managers, of course, see to it that they have ample supplies of fuel on hand to insure them against shutdown due to strikes or failure of delivery for a reasonable length of time. For those who have no long-term contracts for coal, however, it might be well to give the present situation consideration. Production of coal has fallen off owing to lack of buying, and it may be that advantageous arrangements can be made. However, one must be careful to discern between what is legitimate and what is propaganda. For obvious reasons, the railroads and the coal operators would like to have the public believe that another fuel crisis stares it in the face, and already Jeremiahs are stalking through the land chanting this lamentation. Managers should guard themselves against being stampeded into a decision which might not be to their best interests. None should be made until all the facts have been ascertained, and then action should be calm and dispassionate. It would be the height of folly to order if the result would be to bring about a rise in price.

Water-Power Legislation Urgent in New York State

AN INTEREST spreading much farther than the state's boundaries attaches to the water-power bill introduced into the New York State Legislature on the recommendation of Governor Miller. This is partly because the population and importance of the state and its abundant water power make any example set by it loom large in the eyes of sister commonwealths with similar problems and partly because of the possibilities glimpsed for a combat over jurisdiction with the federal government. The bill itself follows in large measure the lines of the congressional act. It provides for a water-power commission made up of state officials which will make surveys and investigations and issue licenses to prospective hydro-electric companies. These may be organized under franchises running for fifty years, the government licenses to run for a similar term. Rates, service and capitalization are to be regulated by the state through the Public Service Commission. The bill contains many provisions designed to protect the public interest and, again following the trend of federal legislation, bars the use of power for manufacturing purposes within the Adirondack State Park. It will doubtless be thoroughly thrashed out in the Legislature and will receive the full impact of the attack of those who believe in government ownership and operation of water-power projects. With the Governor behind it and the large party majority at Albany, it is likely to win. At any rate, it will again direct the attention of the whole state to the tremendous amount of water now running to waste in its streams and rivers and to the ever-growing urgency of transmuting this lost power into electricity for the benefit of all the inhabitants.

Executive Duties of Industrial Electrical Engineers

IN THOSE industrial plants sufficiently large to maintain an electrical department to look after the efficiency of operation and repair of electrical equipment the responsibilities of the head of such a department require more than a technical and practical knowledge of apparatus employed. Although the value of electrical energy is usually a small part of the total production cost of a manufactured product the possible economies that may be effected through its application as light, heat and power and the improvements in quality of the product or increases in output can be shown to pay a handsome dividend on the amount expended in the maintenance of the electrical organization. In too many plants, both large and small, the man whose duties are those of combined production manager and industrial electrical engineer is poorly equipped both with assistants and investigating facilities. In such instances he is compelled to spend his time doing routine work that a handy electrician can do equally well under proper supervision, with no time to devote to original thinking or the conducting of investigations and research leading to possible improvement of the operation of productive processes. The value of studies of lighting to improve production and of speed control to accelerate output or improve the quality of product have been recognized, and in such work the industrial electrical engineer functions as a plant executive just as effectively as the executive whose duty it is to see that the greatest possible return is earned for stockholders on the capital invested. In times like the present, when plant managements are looking for ways and means to economize, the professional side of plant engineering is often overlooked unless the engineer charged with this work is far sighted enough to see the opportunity to apply his ability as an executive and express the results in terms of operating economies, detailed costs and other terms of plant production that

the executive head of the business can recognize as important aids in the interpretation of monthly balance sheets of complete plant operation. A practical application of the homely definition of the engineer as a man who can do more with one dollar than a non-technical man can do with two is that it often defines the difference in the position of the ordinary engineer electrician and the industrial electrical engineer with a recognized executive standing.

Which Are Navigable Streams?

DURING the last nine months something like 180 applications have been made for preliminary permits to develop water-power sites on navigable and nearly navigable streams. These permits when granted will maintain priority of application for licenses to develop these particular sites under the terms of the new water-power law for a period not exceeding three years, this time being allowed for making examinations and surveys and the necessary financial arrangements. But before such work can be definitely undertaken it is essential that the applicant shall know whether or not the stream for which the application has been made will be declared by the Federal Power Commission navigable and subject to such provisions. Complaints are being registered that so far action on this point is being delayed by the commission beyond what seems a reasonable time.

There are many small streams that are not now navigable and never will be, and still others which it is highly improbable will ever be used for purposes of navigation. It is sufficiently absurd to include in a definition of navigable waters an entire stream from its source to its mouth, but it is superlatively so to include small streams which are obviously outside the definition altogether. These small streams might at least be declared non-navigable for a period of ninety-nine years or some other reasonable time to allow the present generation to provide those who follow with sufficient data to determine to what extent builders of water-power plants are the desecrators of our natural resources they are now imagined to be.

The Federal Power Commission is handicapped somewhat in the matter of giving prompt decisions on whether or not any specific stream is navigable because when a preliminary permit covers the development of a power site on that stream the commission must in each case await a report from the Corps of Engineers of the army. Yet the references to "navigable waters" in Section 3 of the water-power act, and again in the last paragraph of Section 23, seem to give the commission wide latitude in its definition of this term, for the language of the sections cited makes it certain that "navigable waters" are not necessarily such as can be navigated. The Niagara River is, according to the definition in the act, "navigable waters," despite the fact that the great cataract has prevented successful navigation on that river past the city of Niagara Falls. Delays in defining the actual point at which a stream is navigable will only postpone definite action on the part of the applicant for a license to build and will retard unduly the needed construction program. Apparently the Federal Power Commission is disposed to act promptly, and since the Secretary of War is a member of the commission he should see to it that the Corps of Engineers renders prompt rulings.

Interesting Bus and Switch Layout of New Chicago Station

AS GENERATING stations grow larger the problem of control of short circuits becomes of increasing importance. Two conditions are to be considered in design. The first is that caused by the grounding of one phase of the bus. This condition can be brought under control by grounding the generator neutral and by the use of a ground resistance. The current can be limited to any desired value. The design problem then becomes one of mechanical strength and proportioning of conductors to care for the stresses due to magnetic influences and heating effects due to current values. The second condition is that caused by interphase short circuits. This factor in the problem is not only beyond control but it is impossible to provide any design that will limit the effect when such a short circuit occurs. The destructive results are limited only by the capacity of the generating equipment feeding into the short circuit.

The design problem is one of preventing such short circuits. Elsewhere in this issue B. G. Jamieson describes the bus and switch layout for the new Calumet plant of the Commonwealth Edison Company, an extremely interesting departure from the conventional design in the attempt made to preclude interphase short circuits by segregating the phases. The distance between phases in this layout is such that there seems to be no possibility of short circuits occurring. Although applied so far only to the indoor type of apparatus, Mr. Jamieson points out the possibility of readily adapting the method to the semi-outdoor type of switch house, and in addition there would seem to be no reason why it should not be applied to outdoor layouts. With the increase in short-circuit capacities in power plants and the rapid increase in the use of higher voltages the Calumet layout deserves the careful study of all designers interested in power-plant or substation work. It contains a decided promise of simplification on indoor installations combined with an increased safety to operators and to the service that cannot be ignored, and it is not improbable that its application to outdoor layouts will result in benefit. A feature that is not brought out particularly in the article is the tendency toward the unit system of design. This is very marked, as will be seen from a study of the drawings.

A Valuable Steam-Station Byproduct

THE amount of combustible thrown away in power-plant ash is a loss which utilities might have overlooked when coal was cheap but which they cannot now afford to neglect at the prevailing price of coal and with inflexible rates for service. Electric light and power companies in the Middle West find that 25 per cent or more of their ash is of combustible material, and as the coal they use has a high ash content it not infrequently happens that companies lose in this way 5 per cent or more of the total heat value of the coal. Attempts have been made to reclaim the combustible from the ash, but apparently with very little result. The advisability of setting aside one or more boilers to reburn the ashes has been considered, but tests made by the Commonwealth Edison Company years ago indicate that fuel containing more than 40 per cent ash is not satisfactory for making steam. Before the war

one of the large companies planned to wash ashes over agitators, but nothing has been done in this direction up to now. However, if mining and other industries can successfully reclaim valuable products from what was once considered waste, it would seem that the heat units which are being thrown away in power-plant ashes are not entirely unrecoverable. What is needed is more careful firing at the start and apparatus suitable for the fuel used.

Operating Ratio of Light and Power Systems

MUCH has been written during the past few years concerning the prodigious growth of the electric light and power industry, and executives have pointed with enthusiasm to the fact that, despite the present widespread depression in most industries, the electrical energy market has been greater than at any time during the war rush. Moreover, a new high record for gross revenue from sale of energy has been reported during the past winter. But these sweet morsels would turn to sour if further investigation showed that the operating and maintenance expenses were relatively on the increase. Such is not the case, however, as is proved by the data on operating and maintenance expenses published in this issue, the ELECTRICAL WORLD having added the collection of figures covering this outlay to its monthly survey of central-station operations. From these data the ratio obtained between operating and maintenance expenses and gross revenue shows a decided drop during the past year. This is particularly noticeable where companies are operating systems made up of both steam and hydro-electric plants. In such cases the operating ratio has decreased from 46.5 in January, 1920, to 38.7 in January, 1921. The operating ratio in January of both years has been found for companies reporting operations of steam plants only, for hydro-electric plants only and for systems composed of both steam and hydro plants, and for comparative purposes these ratios are given for each section of the country. The figures presented on operating ratio are encouraging in the extreme. They form, with the data on output and gross revenue, an argument for the soundness and stability of electric light and power securities which, if used to advantage, should clear away many of the clouds through which the investing public has viewed these securities in the past.

Regulation of Electrical Service in Mines

THE steadily increasing use of electrical equipment in coal mining is certain to have eventually a very important bearing on the cost of production. However, it is quite possible to make regulations so severe as substantially to prevent the general use of electrical coal-mining machinery. On the other hand, it is possible to treat the matter so loosely as not properly to protect the workmen against needless risks. In this issue L. C. Ilsley of the United States Bureau of Mines gives a good summary of the present situation.

Twenty-one states refer in one way or another to electrical coal-mining equipment. Only four go into the matter to any material extent, and but one goes far enough to insist on the employment of a competent electrician in mines where electricity is used underground for power purposes. There is no general agreement as to the voltages which may be employed or requirements for insulation. Some states allow high-tension wiring to be taken underground with proper restrictions. Others limit the underground voltage to 600 or less, whereas in point of fact a badly installed 600-volt circuit is much more dangerous than one for four times that voltage installed with suitable care.

Conditions are such that further regulation with some approach to uniformity of conditions from state to state is highly desirable for the sake of everybody concerned. The makers of machinery want to know what they will be permitted to do. Its users should know the precautions which they are expected to take and the provisions which they must make for inspection. Workers have a right to be sure that their safety is adequately guarded. An agreement ought to be reached for community of action in the establishment of a reasonable and workable code, but care must be taken that all interests concerned have a voice in such standardization.

Where a Superpower Plant at Mine Mouth Is Feasible

PROPOSALS made in the last few years to locate superpower plants at mine mouths have confused the fundamentals of good engineering by the omission of a complete consideration of the problems involved. However, there are conditions under which superpower plants so located are feasible and desirable, and we are glad to give a detailed account of one in this issue, the Colfax station of the Duquesne Light Company, Pittsburgh. Connected by a private railroad with a coal mine only one mile away, and situated directly on the Allegheny River, which has ample circulating water for a 300,000-kw. development, this station possesses two advantages that cannot be found everywhere. Furthermore, it is strategically placed only 15 miles from Pittsburgh and on the opposite side of a double power loop from Brunot's Island generating station—the next largest station on the company's system. With facilities for receiving coal by water or rail in addition, and with the ever-growing steel center of Pittsburgh as a market for energy, a station could not be much better situated for generation of energy at the mine on a gigantic scale. When completed Colfax will be rated at 300,000 kw. in six mighty triplex units, one of which will be a spare. One of the turbo-generator sets, rated at 70,000 kw. (maximum), is installed, and it is more than likely that others will be called into service rapidly.

The station is such an excellent example of up-to-date design embodying time-proven methods that rather than point here to any of its features we refer our readers to the detailed account on page 753. Information of interest is there given on how delivery of coal to the boilers is assured, on an unusual mounting of boilers, a rather uncommon method of maintaining a heat balance, methods of operating the triplex turbo-generators under abnormal conditions, and other provisions for securing maximum economy, reliability and simplicity.

Full data on the performance of the plant are not yet available, but indications are that the unit now operating will show a coal consumption of 1.39 lb. per kilowatt-hour at 50,000 kw. load. With a capacity ultimately to be very big, this record is most encouraging for a start-off, the more so since simplicity and careful planning of the plant have brought the actual cost to about $105 per kilowatt—a remarkably low figure considering the time at which the plant was built.

Frank Shreve Price

One of the builders of the electrical trade and a leader in any co-operative movement within the industry which has its foundation in efficient organization

LEADERSHIP in any industry demands qualities of mind which respond to varying stimuli and achieve success through the power to resolve complex situations into clear-cut working programs. When such abilities are combined with unselfish devotion to the common good the result is a realization of ideals in every-day affairs which turns competitors into friends and wins widespread regard. A man with these qualities is Frank S. Price, president of the Pettingell-Andrews Company of Boston and one of the foremost electrical supply jobbers of America. A native of Salem, Mass., Mr. Price entered the electrical business about thirty years ago as a store boy in the organization which he now heads, gradually rising to the posts of office manager and sales manager, filling every position ably and making a growing reputation for high-minded service in the wholesaling field.

Himself a master of detail, Mr. Price has never practiced putting petty restrictions upon his subordinates, but has won their intense loyalty through his confidence in them and his backing of them in sound and progressive methods. He has spent without stint his own time and money in experiments for the good of the industry. Hard work, vision, prompt decisions, an analytical mind and a sympathetic understanding of the broad problems of the industry, as well as an insight into the relationships existing and possible between its branches, have given Frank Price an influence for sound merchandising in national counsels.

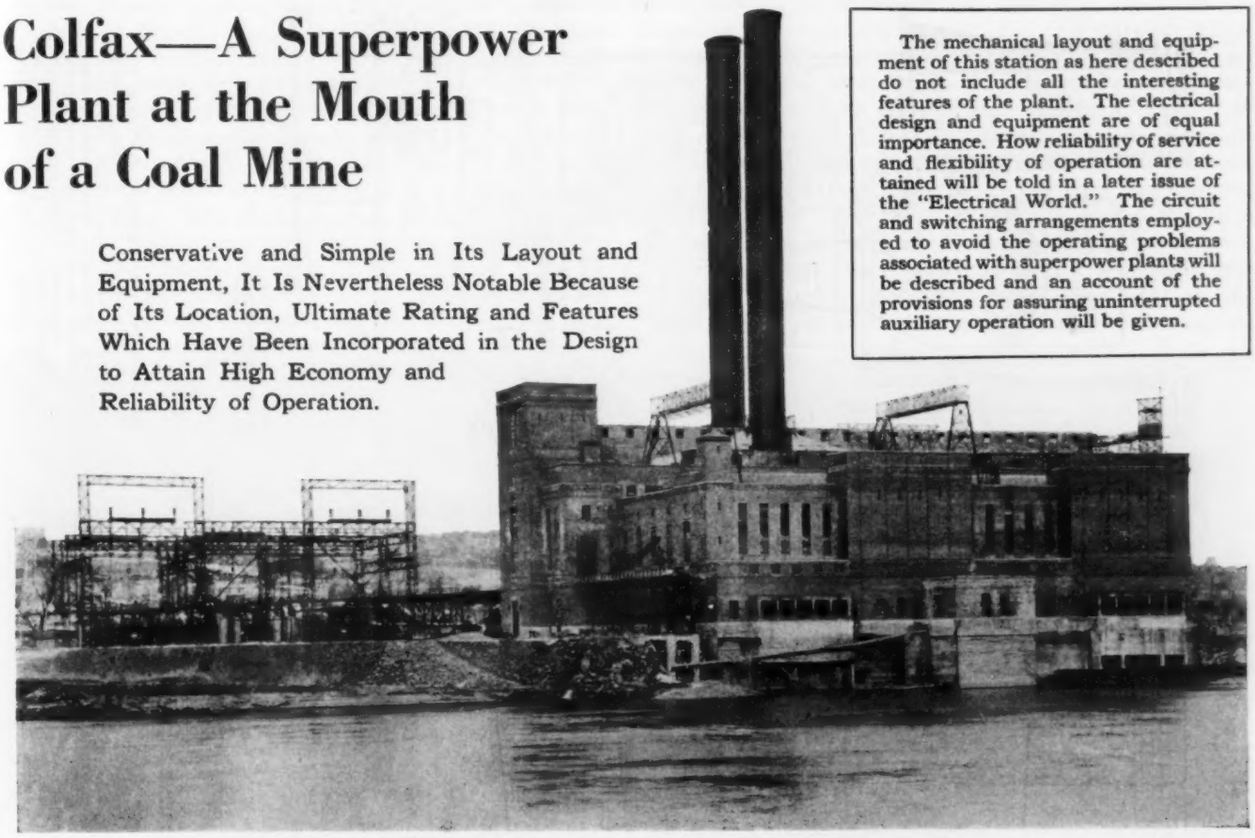
He is a former chairman of the Atlantic Division of the Electric Supply Jobbers' Association and is at present an executive committee member of that organization. He is also a member of the National Electric Light Association and of the New England Electrical Supply Jobbers' Club. Constructive co-operation and unswerving championship of the square deal in business have characterized Mr. Price's work from the beginning and have enriched the industry of his choice.

Recognized by the War Industries Board as being a factor in the economical distribution of electrical merchandise the electric supply jobbing business has made a secure place for itself largely because of the principles adhered to by its leaders, among whom is Mr. Price. It is not surprising therefore that there are few industries in which the jobbing branch commands so great respect. From being merely a handler of orders between the customer and the producer the jobber is now a merchant maintaining a stock sufficient to meet the demand even under the most trying conditions. Quality goods at the lowest price commensurate with such a high degree of service and a fair profit now characterize the electrical supply jobbing business of the United States, which last year, it has been conservatively estimated, did a wholesale business considerably in excess of four hundred millions of dollars.

Colfax—A Superpower Plant at the Mouth of a Coal Mine

Conservative and Simple in Its Layout and Equipment, It Is Nevertheless Notable Because of Its Location, Ultimate Rating and Features Which Have Been Incorporated in the Design to Attain High Economy and Reliability of Operation.

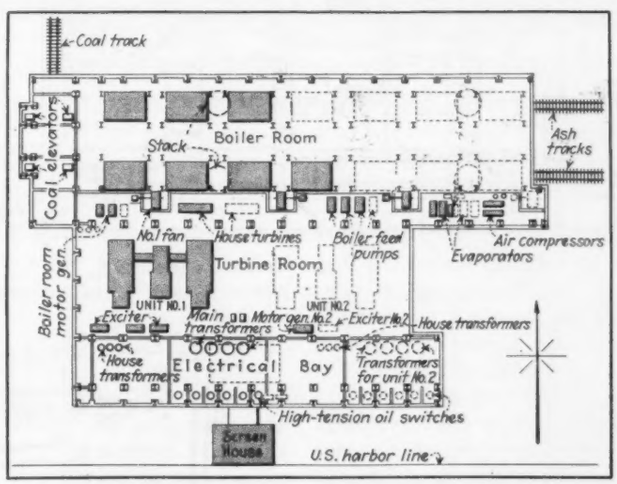
The mechanical layout and equipment of this station as here described do not include all the interesting features of the plant. The electrical design and equipment are of equal importance. How reliability of service and flexibility of operation are attained will be told in a later issue of the "Electrical World." The circuit and switching arrangements employed to avoid the operating problems associated with superpower plants will be described and an account of the provisions for assuring uninterrupted auxiliary operation will be given.



FIRST STEP OF 300,000-KW. COLFAX POWER STATION TO HOUSE TWO 60,000-KW. UNITS

TO PROVIDE Pittsburgh, the steel center of the United States, with ample and dependable power, the Duquesne Light Company has built around the city a double "power ring" into which energy is fed by the most reliable generating stations that present engineering knowledge can provide and from which distribution lines radiate to places of energy utilization. In anticipation of increased power demands and to increase still further the reliability of electric service a new generating station, known as Colfax, has recently been completed and connected to the "power ring." This station is notable in many ways, chief among which are its ultimate rating and size of units, the low unit cost of construction, the simplicity of design and the reliability and economy of operation which are anticipated. Neither the designers nor the operators of this station claim for it any radical departures from general practice, but place emphasis rather upon its simplicity and conservatism. The method of construction and general layout represent a combination of some of the best ideas available in power-plant engineering for the conditions involved.

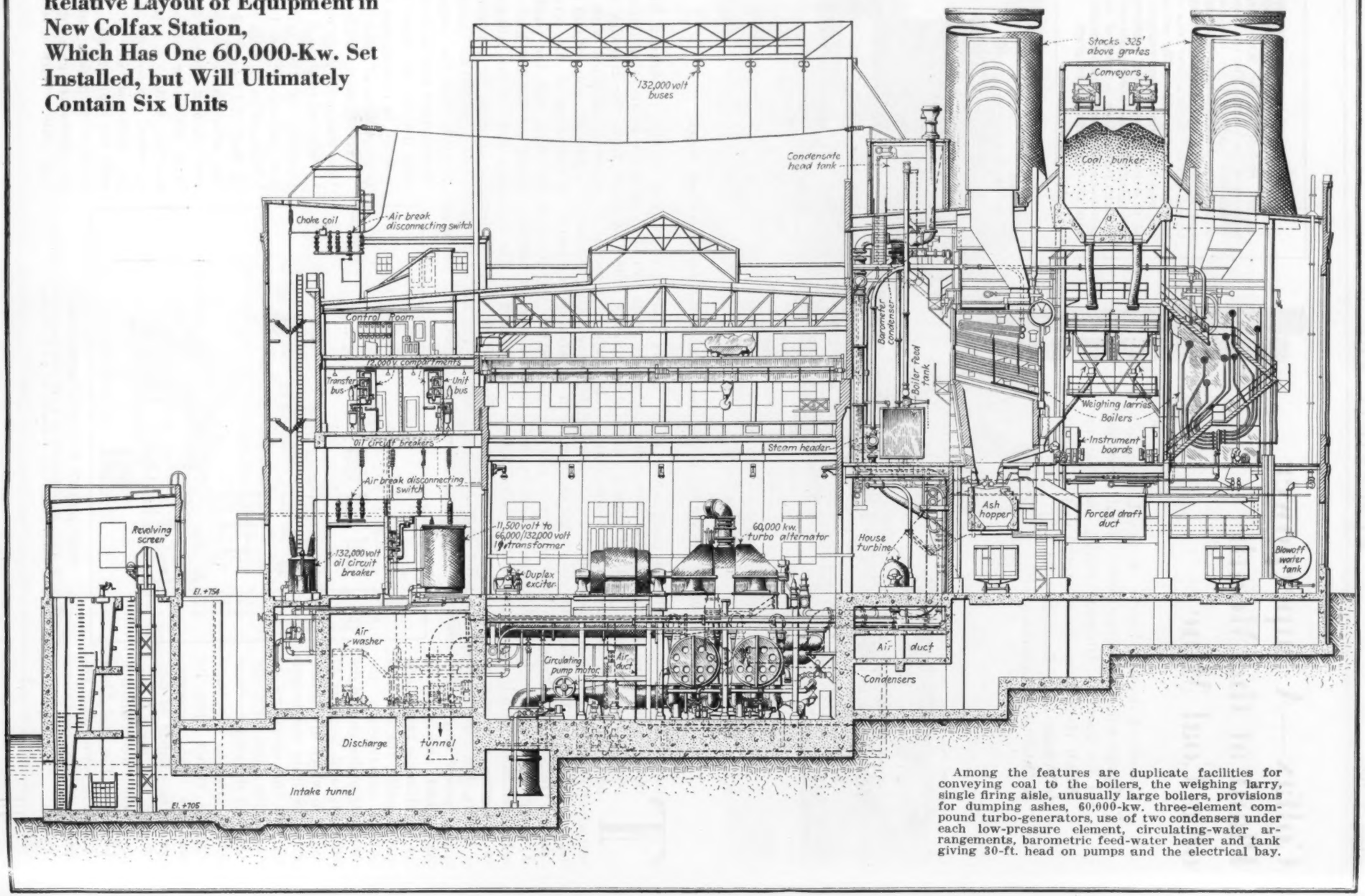
Colfax station is situated on the Allegheny River about 15 miles (24 km.) from the center of Pittsburgh and only one mile (1.6 km.) from the Harwick coal mine, which is owned by interests affiliated with the Duquesne Light Company. Although only 60,000 kw. in generating equipment is operating at the present time, 60,000 kw. more is on order, and the plant is designed for an ultimate rating of 300,000 kw.—the capacity fixed by the minimum flow of the Allegheny River, from which the station receives its condensing water. The size of the units chosen, 60,000 kw. nominal and 70,000 kw. maximum, is such that the ultimate development may be divided into five or six steps and will not be complicated by a large number of small units.



FIRST SECTION OF COLFAX DEVELOPMENT
Single firing aisle, arrangement of turbo-generators and respective transformers are features of plant layout

Arrangement of the station was influenced chiefly by the relative floor space occupied by the turbines and boilers. The latter, which are 34 ft. wide by 22 ft. deep (10.2 m. x 6.6 m.), are arranged in a double row with a single firing aisle, while the turbo-generators, which are three-cylinder compound units, are arranged side by side with the high-pressure element in the middle and one low-pressure element on each side. With this ar-

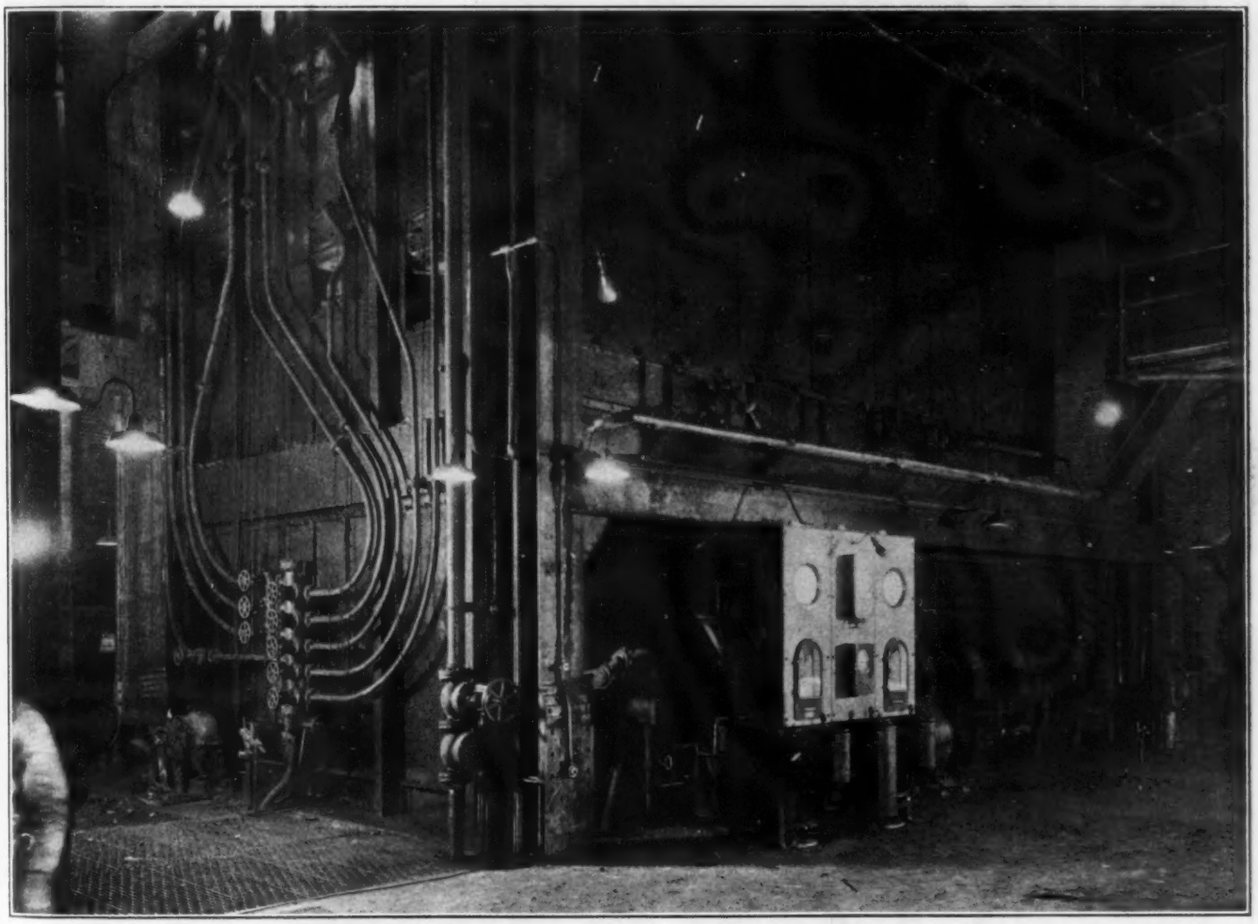
Relative Layout of Equipment in New Colfax Station, Which Has One 60,000-Kw. Set Installed, but Will Ultimately Contain Six Units



Among the features are duplicate facilities for conveying coal to the boilers, the weighing larry, single firing aisle, unusually large boilers, provisions for dumping ashes, 60,000-kw. three-element compound turbo-generators, use of two condensers under each low-pressure element, circulating-water arrangements, barometric feed-water heater and tank giving 30-ft. head on pumps and the electrical bay.

rangement each turbine (that is, the three elements) occupies a space of about 51 ft. (15.3 m.) in the direction of the shafts by 79 ft. (23.7 m.) at right angles to the shafts. Allowing for a pit between each pair of turbines into which parts may be lowered for repairs or overhauling, the turbine room measures 278 ft. (84.7 m.) in length, compared with 350 ft. (106.6 m.) for the boiler room, so that there is an approximate balance between the two rooms. Including the electrical bay, which runs parallel to the turbine room, the station is 240 ft. (73.1 m.) wide over all, made up of 108 ft. (32.9 m.) for the boiler room, 84 ft. (25.6 m.) for the turbine room and 48 ft. (14.6 m.) for the electrical bay.

To permit the movement of coal with the least rehandling and to utilize gravity for this purpose wherever possible, hopper cars are brought to the plant on an elevated trestle, from which they may be dumped into the storage yard or directly into duplicate track hoppers at the station. If necessary, the cars may be dumped directly into barges for delivery to Brunot's Island or other stations. When the cars are dumped in the storage yard the coal may be picked up by a clamshell bucket operated from a hoisting tower on a traveling bridge and discharged onto a reversible belt conveyor, also on the bridge, which carries it to the point where it is dumped by an automatic tripper. Coal



SEVEN CROSS-DRUM BOILERS ARE NOW INSTALLED WITH INSTRUMENT AND CONTROL BOARDS IN FRONT OF EACH BANK

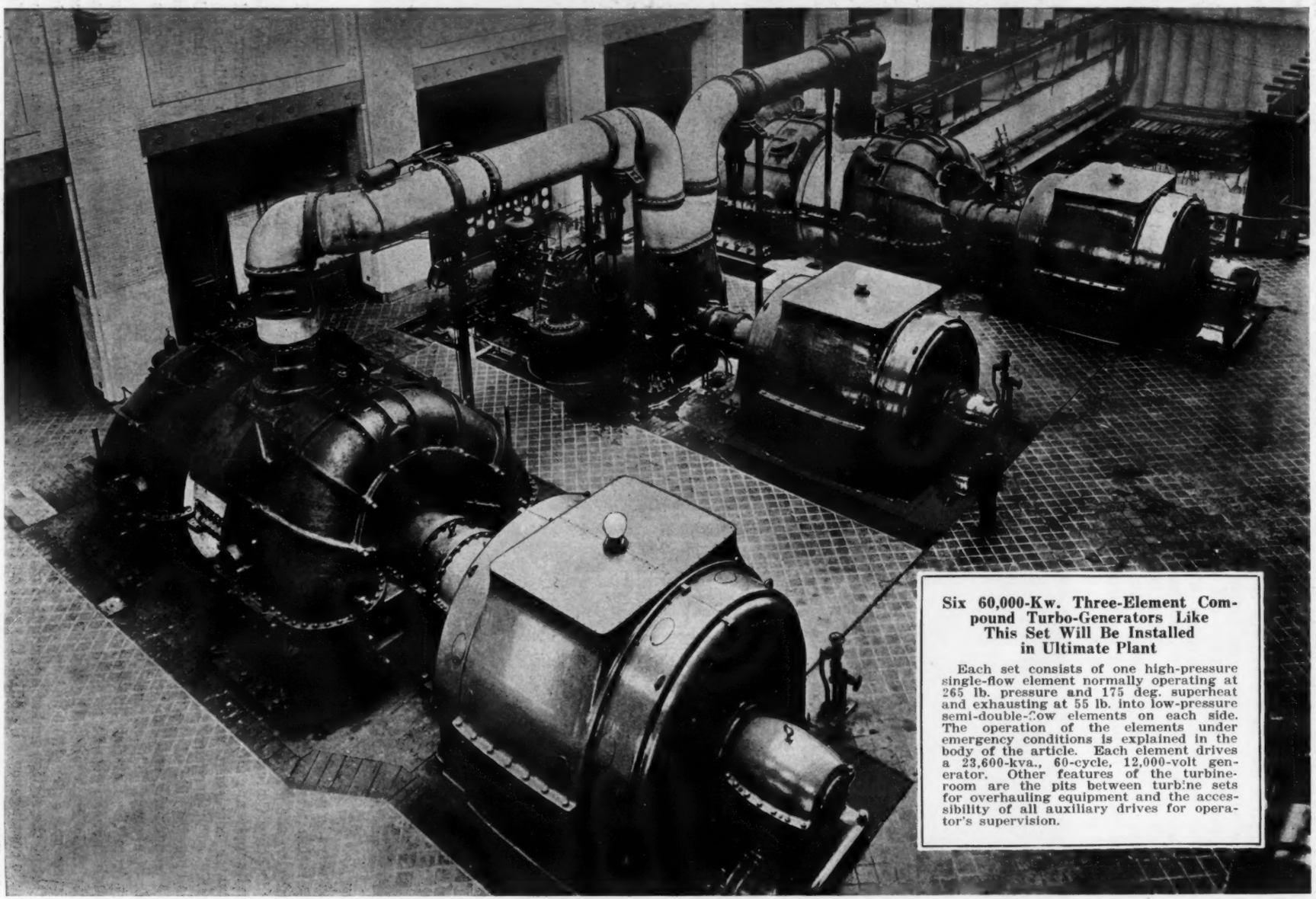
The ways in which economy, reliability and simplicity of operation were attained can best be explained by considering the plant in detail.

By locating Colfax station where it is several sources of coal supply are afforded and the maximum condensing water consistent with other advantages is made available. Furthermore, the location places the station at the opposite side of the "power ring" from Brunot's Island generating station, which is the next largest source of energy. The normal supply of coal will come direct from the Harwick mine over a private railroad, although fuel can also be received by water or over the Pennsylvania Railroad. The additional precaution of providing space for 150,000 tons of storage within a few feet of the station makes interruption of fuel supply a remote contingency. By piling the coal 40 ft. (12 m.) high an emergency storage of 250,000 tons may be obtained.

may be reclaimed by the same equipment, in which case the conveyor will discharge into hoppers on the end of the bridge over the trestle.

To provide for the receipt of coal by barges, a high-speed hoisting tower will be erected at the river end of the coal trestle. This will dump onto either of two belt conveyors parallel to and above the trestle. Coal may be dropped from one belt into the power-house hoppers or from either belt into the railway cars if coal is to be placed in outdoor storage.

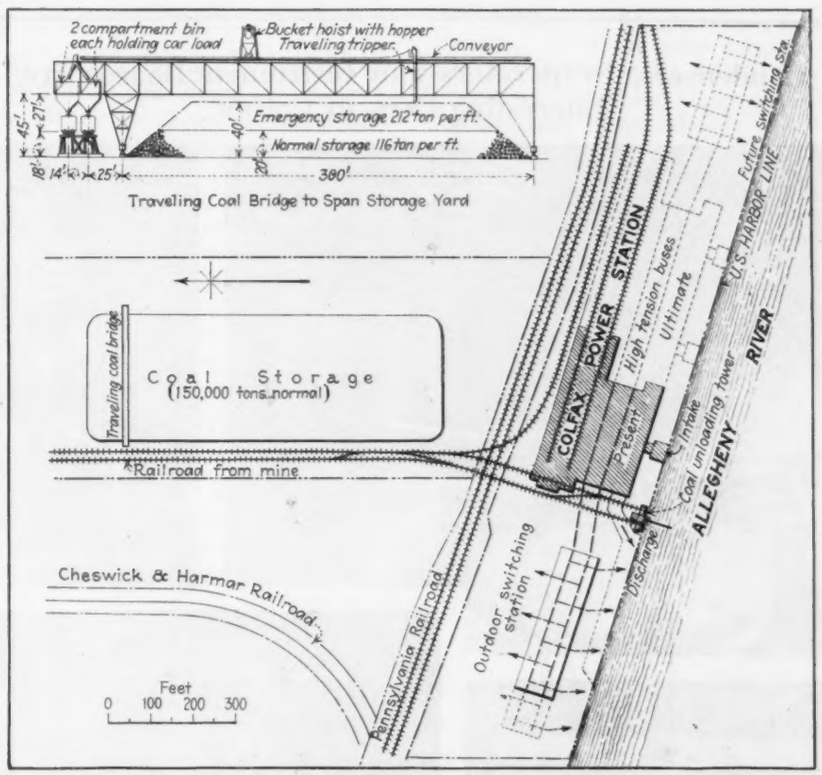
To avoid the difficulties usually experienced in repairing or overhauling coal crushers in this plant the crushers have been placed directly under the track hoppers where they are readily accessible. They discharge into bucket elevators which transfer their load at the top of the coal tower to belt conveyors running over the boiler-room bunker, into which coal is distributed by automatic traveling trippers. The duplication of coal-handling



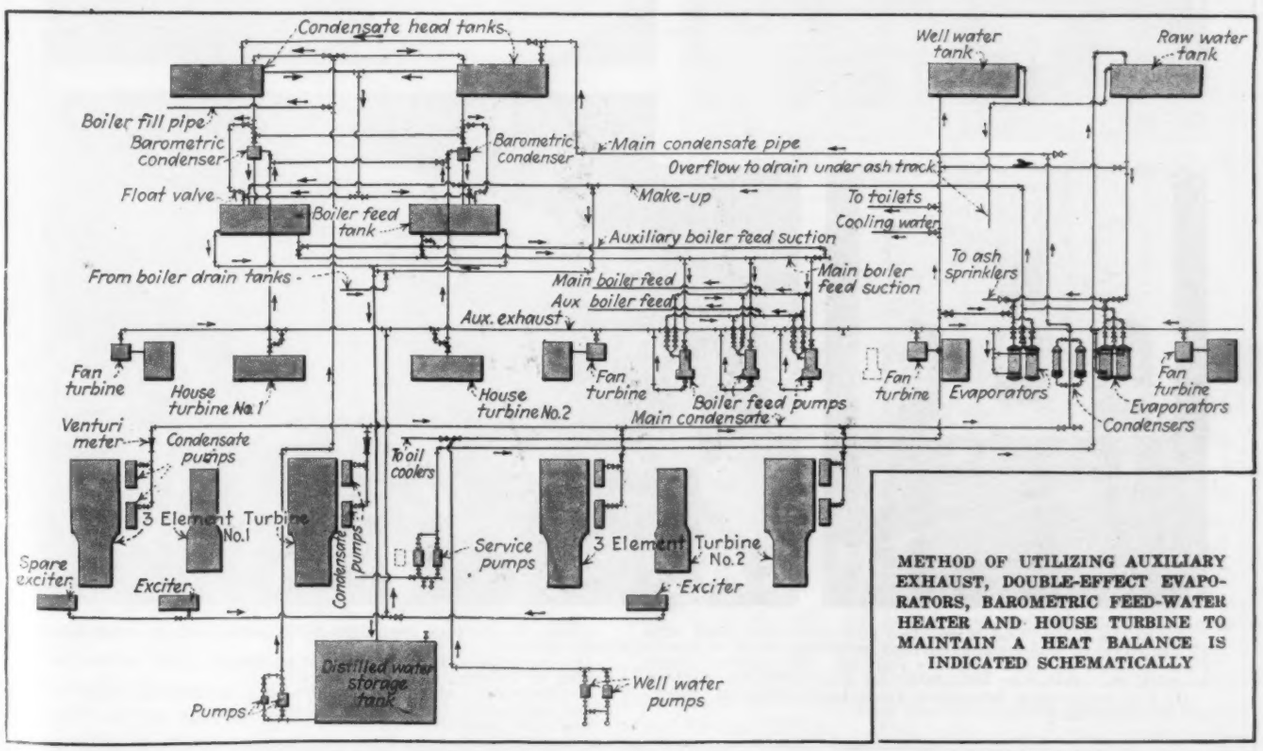
Six 60,000-Kw. Three-Element Compound Turbo-Generators Like This Set Will Be Installed in Ultimate Plant

Each set consists of one high-pressure single-flow element normally operating at 265 lb. pressure and 175 deg. superheat and exhausting at 55 lb. into low-pressure semi-double-flow elements on each side. The operation of the elements under emergency conditions is explained in the body of the article. Each element drives a 23,600-kva., 60-cycle, 12,000-volt generator. Other features of the turbine-room are the pits between turbine sets for overhauling equipment and the accessibility of all auxiliary drives for operator's supervision.

facilities, together with the provision of 240 tons storage over each boiler, virtually precludes any chance of interruption in delivery of coal to the stokers. A continuous sample of the coal is automatically taken from the belts which distribute the coal to the bunker. To avoid the use of weightometers in the chutes to each stoker weighing larries with recording registers are used. Extra-long seventeen-retort stokers are provided so that the boilers may be operated at 300 per cent of rating during peaks. However, the load factor of this station will be so high that the boilers will be operated at 200 per cent to 225 per cent of rating normally to keep down the annual cost of operation. Double-roll clinker grinders cooled by a continuous water spray are installed. Under them are brick-lined concrete hoppers affording ample space for accumulation of ashes, the hopper having a capacity of 1,900 cu.ft. (53.2 cu.m.) per boiler. Air-operated ash gates empty the hoppers directly into standard-gage cars. Seven exceptionally high boilers with drums 35 ft. (10.5 m.) above the floor level are installed to give liberal furnace volume and thus permit complete combustion even at high rates of evaporation. Each boiler has a heating surface of 20,876 sq.ft. (1,920 sq.m.). The ratio of furnace volume to boiler rating is 3.45 cu. ft. (0.09 cu.m.) per rated horsepower. Being eighteen tubes high by fifty-one tubes wide, the boilers give a maximum amount of heating surface per foot of furnace width. As may be noticed from the cross-section of one of the boilers, they are fired from the side on which the tubes are lowest and no bridge wall is employed, the inclined rear wall serving this purpose. To prevent the formation of clinkers, perforated blocks are built into the furnace walls at the coal level. Air leakage is reduced by steel boiler castings. Another feature of the boilers is the arrangement of the steam pipes feeding

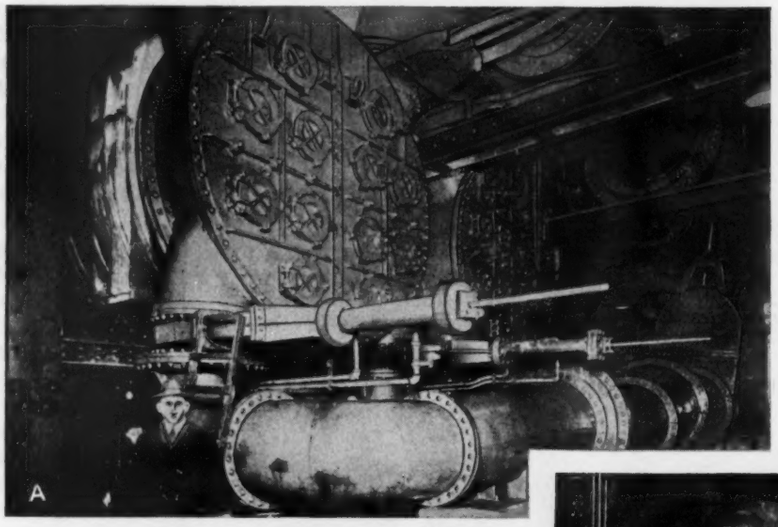


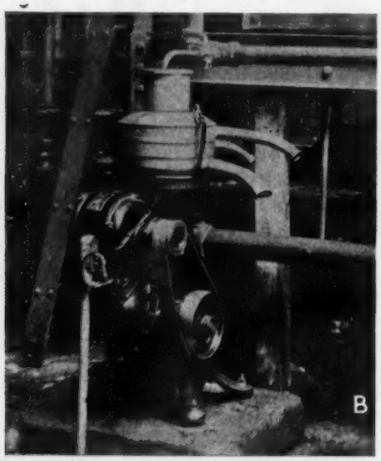
COAL CAN BE RECEIVED DIRECT FROM MINE OR BY RAIL OR WATER

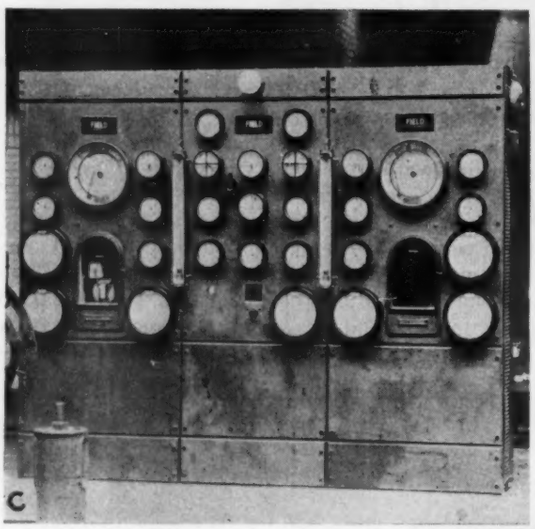


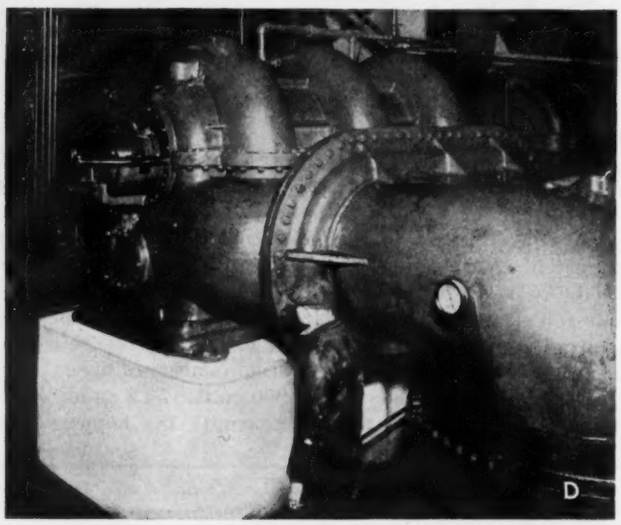
METHOD OF UTILIZING AUXILIARY EXHAUST, DOUBLE-EFFECT EVAPORATORS, BAROMETRIC FEED-WATER HEATER AND HOUSE TURBINE TO MAINTAIN A HEAT BALANCE IS INDICATED SCHEMATICALLY

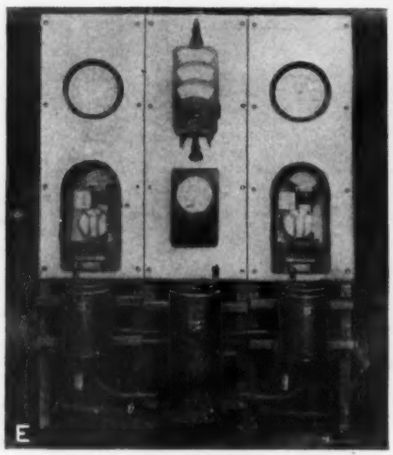
Condensers, Evaporators and Instrument Boards Are Interesting Parts of Colfax

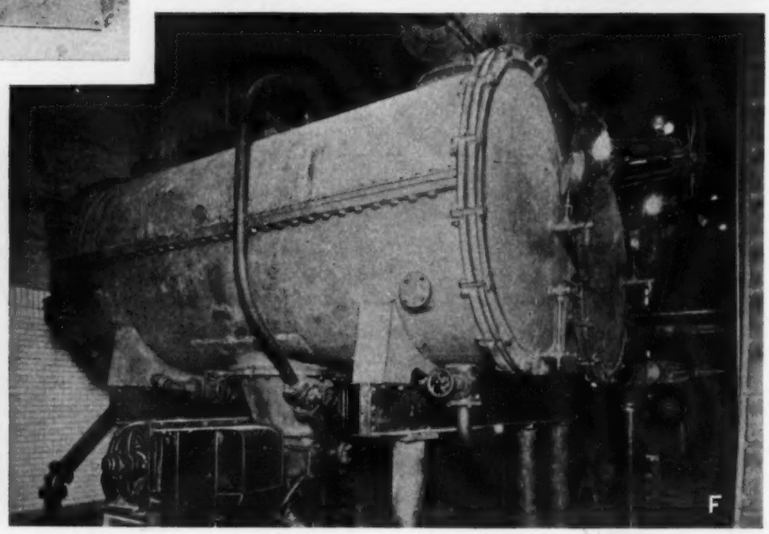

A


B


C


D


E


F

A—In the foreground is one two-pass condenser shell with 25,000 sq.ft. of condensing surface receiving exhaust steam from one end of a low-pressure element. Three other shells complete the condenser equipment for one 60,000-kw. turbine.

B—For separating impurities from lubricating oil motor-driven centrifugal separators are used.

C and E—Turbine room and boiler-room instrument boards respectively.

D—One of the three circulating pumps for each turbine set driven by 600-hp., 2,200-volt motor.

F—Reversible double-effect dry-tube evaporator used to distill raw water for boiler make-up.

the soot blowers. This is shown in the general cross-section of the station.

To enable convenient and economical operation of the boilers an instrument and control board is placed in front of each one on which are mounted two steam-pressure gages, two indicating and recording feed-water meters, one three-in-one draft gage, one CO_2 recorder, a six-pen pyrometer and controllers for the stoker and clinker grinder motors. In addition to the equipment on the boards each boiler has feed-water regulators, front-mounted blow-off valves and extended water columns that are only 5 ft. above the floor level.

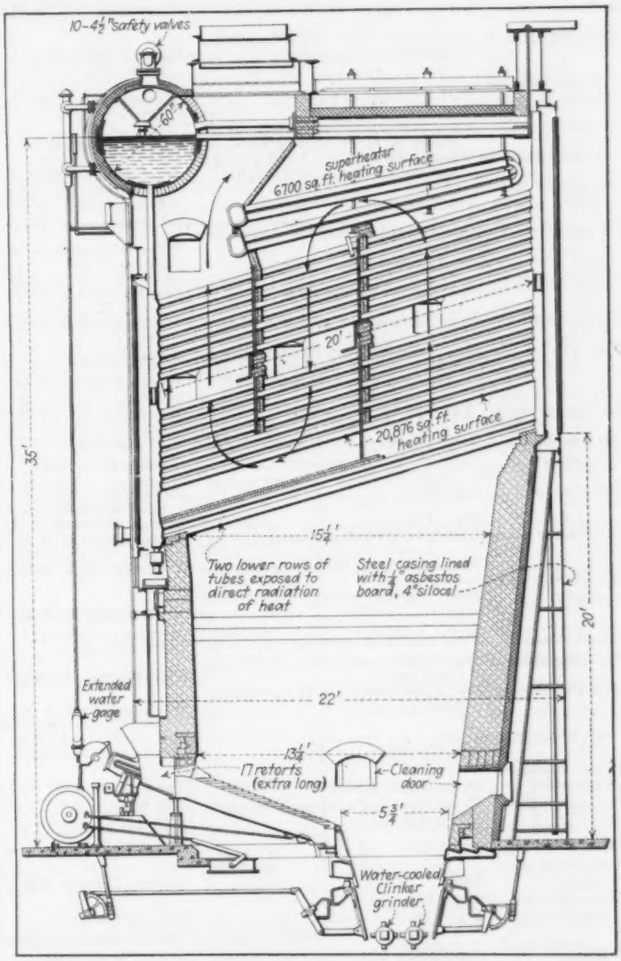
Each group of four boilers is served by one forced-draft fan, which draws a part of its supply of air through the generators, reclaiming the heat radiated therefrom. A duct under the firing aisle permits interconnection of the groups, thus enabling greater flexibility of operation. To make the air pressure correspond with the furnace requirements the fan speed is controlled by the boiler pressure, while the boiler outlet damper is controlled by draft intensity over the fire.

Balanced draft is employed, the gases being drawn away from the boilers through flues on the roof that connect with self-supporting steel stacks 325 ft. (99 m.) high. Placing the flues on the roof saved building expense and avoided overheating the boiler room.

Distilled make-up water for boiler feed is obtained by passing raw water through a reversible double-effect dry-tube evaporator and then condensing it. To obtain the maximum plant economy advantage is taken of part of the exhaust from the steam-driven station auxiliaries to evaporate the raw water and of the main-turbine condensate to condense the water evaporated. The make-up water, the auxiliary exhaust condensed thereby and the condensate from the main turbines are then combined and fed through a barometric condenser to condense the auxiliary exhaust which was not used in evaporating the make-up water. The tail pipe of the barometric condenser terminates in a large tank which is back of one row of boilers and affords a 30-ft. (9-m.) head on the feed-pump suction line.

By regulating the supply of exhaust steam from station auxiliaries the temperature of the tailwater from the barometric condenser can be maintained at the desired feed-water temperature (about 200 deg. Fahr.) without waste of either water or heat. This is done as follows: With the exception of the steam-driven feed pumps, forced-draft fans and house generator, virtually all of the station auxiliaries are operated by induction motors normally supplied from the house-generator circuit. Connected with this circuit, however, is a second source of supply afforded by a generator driven by an induction motor fed from the main generators. When the house generator runs at the same frequency as the main generators the motor-generator will carry no load and the house turbine will carry all of the electrical station auxiliaries. By reducing the speed of the house turbine the motor-generator can be made to pick up some of the auxiliary load on the house circuit and the exhaust steam from the house turbine can thereby be reduced. Since the exhaust from the fans and the feed pump turbines is always less than required in both the evaporators and barometric condenser at any station load liable to exist, the speed control of the house turbine can always maintain the desired heat balance.

Because of the size of the turbo-generators selected for this station it was considered advisable to employ units which are divided into three mechanically distinct elements. Thus the total temperature drop is divided into two approximately equal steps which are utilized in separate machines. Any one or two of the three elements may be operated in case the remainder must be taken out of service for any cause whatsoever. The high-pressure elevator and one low-pressure element may be operated together and carry a load of 30,000 kw. with a steam consumption of 12.6 lb. (5.6 kg.) per kilowatt-hour, or the low-pressure elements may be operated independently, developing a load of 30,000 kw. with a steam consumption of 13.8 lb. (6.6 kg.) When operating at the most efficient load the complete



EXCEPTIONALLY LARGE CROSS-DRUM BOILER, FIFTY-ONE TUBES WIDE BY EIGHTEEN TUBES HIGH

60,000-kw. unit is guaranteed to generate a kilowatt-hour with a steam consumption of 10.58 lb. (4.7 kg.)

Normally, all steam to the three elements is under the control of the governor on a high-pressure element, but each low-pressure element is also equipped with a governor and direct steam connection. If one of the low-pressure elements overspeeds when all elements are operating together, the governor on that element (normally inactive) will close a butterfly valve in the steam pipe between the high-pressure and low-pressure cylinders, thus cutting off all steam to this low-pressure element. The excess steam then coming from the high-pressure element is discharged to the atmosphere through a 25-in. (63-cm.) relief valve set to open at about 60 lb. (27 kg.). This valve will remain open until the operator adjusts the load to the new conditions.

DETAILS OF SOME OF THE MECHANICAL EQUIPMENT

Equipment	Number, Type, Capacity and Size	Manufacturer
Coal crushers	Two 36-in. double-roll, 48 in. wide	Link Belt Co.
Coal elevators	Two overlapping, pivoted bucket, 36 x36 in.	Link Belt Co.
Coal conveyors	Two 30-in., each with automatic traveling tripper	Link Belt Co.
Weighing larries	One, 20 tons capacity	Heyl & Patterson, Inc.
Ash gates	Twenty-one, 5x5-ft., air-operated	Baker-Dunbar-Allen Co.
Boilers	Seven, cross-drum; 20,876 sq.ft. surface; 51 tubes wide, 18 tubes high; 275 lb. pressure	Babcock & Wilcox Co.
Superheaters	Seven, Foster; 6,700 sq.ft.; 180 deg. superheater	Power Specialty Co.
Clinker grinder	Fourteen-double-roll	Westinghouse E. & M. Co.
Soot blowers	Seven, 18 units per boiler	Diamond Power Spec. Co.
Stokers	Seven, 17-retort, extra-long	Westinghouse E. & M. Co.
Forced-draft fans	Three, radial flow: 250,000 cu.ft. per minute at 6-in. pressure	Green Fuel Economizer Co.
Forced-draft turbines	Three, 420-hp., geared	Westinghouse E. & M. Co.
Stacks	Two, self-supporting steel, 21 ft. diameter, 325 ft. above grates	American Bridge Co.
Boiler-feed pumps	Three, Jeanesville; 1,500 gal. per minute; four-stage centrifugal	Worthington Pump & Mchry. Co.
Boiler-feed turbines	Three, 400-hp	Westinghouse E. & M. Co.
Evaporators	One, Lillie, double effect; 15 tons per hour	Wheeler Condenser & Engrg. Co.
Feed-water heater	One, barometric-condenser type	Westinghouse E. & M. Co.
Condensers	Four, surface type, 25,000 sq.ft. each.	Westinghouse E. & M. Co.
Turbines	One, three-element compound, consisting of one high-pressure and two low-pressure elements	Westinghouse E. & M. Co.
Exciter turbines	Two, 650-hp	Westinghouse E. & M. Co.
Air washers	Two, 115,000 cu.ft. per minute	B. F. Sturtevant Co.
Oil purifiers	Two, 100-gal. per minute	Turbine Equipment Co.
Relief valve	One 25-in	Pittsburgh Valve, Fdry. & Cons'n Co.
Circulating pumps	Two, 42-in Three, 44,000-gal. per minute	Atwood & Morrill Westinghouse E. & M. Co.
Air pumps	Three, Le Blanc, 30 cu.ft. per minute.	Westinghouse E. & M. Co.
Condensate pumps	Four, 1,000 gal. per minute, centrifugal	Westinghouse E. & M. Co.
Intake screens	Two, revolving; each 7½x54 ft.	Chain Belt Co.
Traveling crane	One, 75-ton main hoist; 25-ton auxiliary hoist	Niles-Bement-Pond Co.
House turbine set	One, 2,000-kw. turbo-generator, 3,600 r.p.m.	Westinghouse E. & M. Co.
Recording pyrometer	One, six-pen	Thwing Instrum't Co.
Boiler damper regulators	Seven, balanced-draft	The Engineer Co.
Fan controllers	Three, operated by steam pressure	The Hagan Corp.
Draft gages	Seven, 3-in. one	Precision Instr'm't Co.
CO_2 recorders	Seven	Joseph W. Hays Corp.
Feed-pump governors	Three	Edward Valve & Mfg. Co.
Boiler-feed controllers	Eight, Stets Six, Copes	Williams Gauge Co. Northern Equipmt. Co.
Boiler-feed meters	Fourteen, 4-in	Simplex Valve & Meter Co.
Large condensing water gate valves	Motor and hydraulically operated.	Pittsburgh Valve Foundry & Cons't'n Co.
Indicating and recording flow meters	Two, 18-in	General Electric Co.
Condensate meters	Two, 8-in	Simplex Valve & Meter Co.
Coal gates	Twenty-one, duplex	C. W. Hunt Engrg. Co.
Smoke flues and forced-draft ducts	Sheet metal	Connery & Company
Evaporator meters	Two, Venturi type	Simplex Valve & Mfg. Co.
Pipe and flue covering		H. W. Johns-Manville Co.

Of the remaining mechanical equipment expansion joints were furnished by E. B. Badger & Son Company., Westinghouse Electric & Manufacturing Company, U. S. Rubber Company and Pittsburgh Valve, Foundry & Construction Company; miscellaneous pumps by Blackmer Rotary Pump Company, Yeomans Brothers Company, Worthington Pump & Machinery Company, Lawrence Machine Company and Westinghouse Electric & Manufacturing Company; miscellaneous valves by Pittsburgh Valve, Foundry & Construction Company, the Edward Valve & Manufacturing Company, the Chapman Valve Manufacturing Company, Fairbanks Company and Golden-Anderson Valve Specialty Company.

If the automatic stop valve on the high-pressure element closes, because of overspeed or other causes, when the three elements are operating, all steam to the group will be shut off and the unit will slow down. As soon as the speed falls approximately 3 per cent, however, the valves admitting boiler steam to the two low-pressure elements are automatically opened and these elements continue to carry load under the control of their independent governors.

Should the automatic stop on a high-pressure element function when the high-pressure and one low-pressure elements are operating together, the low-pressure element will continue to carry load, taking steam direct from the boilers. Should the governor on a low-pressure element close the butterfly valve in the steam line between the high-pressure and low-pressure units, the high-pressure element will continue to carry its load, exhausting to atmosphere until the load is either removed or the other low-pressure element is brought into service.

Similar turbines have been used by other operating companies (see ELECTRICAL WORLD, May 10, 1919, page 933; Dec. 28, 1918, page 1213, and May 13, 1916, page 1089), and therefore the features of the construction will not be described.

Being of a semi-double-flow construction, each low-pressure element is provided with two exhausts, each discharging into a condenser shell. Connections are made by means of elliptical tubes of §-in. (1.58-cm.) molded rubber 2 ft. (0.6 m.) in length, the ends being clamped to the turbine and condenser flanges respectively. Each condenser shell contains 25,000 sq.ft. (2,300 sq.m.) of condensing surface and is divided into two compartments so that one-half may be isolated for cleaning while the unit is in operation.

For the four condenser shells under each turbine set there are provided three motor-driven circulating pumps discharging into a common header so that any pump or combination of pumps may be operated. Two condensate pumps and two spares are provided to discharge the condensate through the evaporator condenser to the head tank of the barometric feed-water heater. Air pumps of the Le Blanc type are employed instead of steam jets. A somewhat unusual feature made possible by the turbine room being parallel to and near the river is that there is a separate circulating-water tunnel and revolving screen well for each two units. This not only defers the investment in future intake capacity but results in the ultimate cost of the complete plant being less (so far as intake flumes are concerned) than it would be if an intake common to all units were used.

Records are not yet available to show the normal performance of the plant under actual service conditions, but calculated figures indicate that at a load of 50,000 kw. the coal consumption should be about 1.39 lb. (0.62 kg.) per kilowatt-hour, using semi-bituminous coal having the following proximate analysis by percentage: Fixer carbon, 54; volatile matter, 34; ash, 9; moisture, 3; heat value of coal as received, 13,500 B.t.u. per pound (6,075 B.t.u. per kg.).

The information presented in this article as well as that which is to appear later with reference to the electrical features of the station was obtained through the courtesy of C. S. Cook, general manager, and J. M. Graves, assistant general manager of the Duquesne Light Company, and various members of the organization of Dwight P. Robinson & Company, Inc., engineers and constructors.

New Type of Switch House Prevents Bus Short Circuits

Wide Separation of Bus Phases in New Calumet Plant of Commonwealth Edison Company Precludes Interphase Short Circuits — Current-Limiting Reactors Are Utilized for the Purpose of Excluding Outside Disturbances

By B. G. JAMIESON
Engineer of Inside Plant Commonwealth Edison Company, Chicago

ONE central-station company has answered the challenge of concentrated power with a switch house of a semi-outdoor type. Superpower systems of the future will spread their distributing buses country-wide and thus partly escape the challenge. This article describes what is being done toward the attainment of maximum safety with the indoor type of switch house housing breakers of 1,000,000-kva. interrupting capacity and having predominant high-voltage distribution characteristics. Future articles will describe in more detail the electrical equipment of the plant concerned, the new Calumet plant of the Commonwealth Edison Company in Chicago.

That portion of the large modern distribution central station known as the switch house has developed from a humble beginning as a gallery or series of galleries within the room housing the prime mover to a structure of great magnitude and cost. An analysis of the constituents of the cost emphasizes the importance of this primary distribution center. In no other part of the central station is there power concentration equal to that on the bus system of the switch house, and mute reminders of the destructive possibilities of this energy when beyond control urge a higher factor of safety as the concentration increases. For this reason the most important consideration in the design of a switch house is the provision against a bus short circuit, and involved therein are two fundamentals aside from apparatus of adequate design—the proper interphase spacing and phase-ground spacing of conductors. Obviously any arrangement which will eliminate short circuit possibility will greatly increase the factor of safety of the bus system.

It is entirely practicable to design a switch house so as to exclude the possibility of an interphase short circuit upon the bus or any of its tributaries. In any short circuit from a bus phase to ground the current can be limited by a resistance in the generator neutral ground connection and is therefore under control.

In minor switching centers out on the system and away from the concentrated energy center comparative immunity from destructive possibilities may be obtained by the employment of barriers, insulation, armor or its equivalent; but at the energy center where a higher factor of safety is needed because of its relative importance such safeguards are in the main inadequate. Of course, the factor of safety which such safeguards afford can be theoretically increased by simply using more of any one of the three elements, but it is preferable to employ methods which will lessen the need for such safeguards, and a proper grouping and distant spacing of conductors of like phase will entirely eliminate the possibility of an interphase short.

This principle is embodied in the design of the 200,000-kva. (ultimate), 12,000-volt, 60-cycle plant of the Commonwealth Edison Company of Chicago, now under construction, its feasibility at this time being largely due to a willingness on the part of several manufacturers of electrical apparatus to undertake the development of oil breakers adapted to the purpose, which is the largest single accomplishment in this undertaking.

Fig. 1 shows the most elementary type of such construction, but its use would be limited to a small station not requiring duplicate buses, though perhaps for special reasons, other than kilowatt capacity, requiring an extra factor of safety. It is of interest only in making clear the elements of the general scheme.

Figs. 2 and 3 show the essential proportions of a section of the Calumet switch house, and particularly the extreme spacing of the phases of the buses. Fig. 4 is a corresponding under-ceiling plan. The initial impression created by this design is one of prohibitive space requirement, but actual dimensions of the developed plans show little if any additional space required

Important Developments in High-Power Switch-House Design

1. It is entirely practicable to design a switch house so as to exclude the possibility of an interphase short circuit upon the bus or any of its tributaries. In any short circuit from a bus phase to ground the current can be limited by a resistor in the generator neutral ground connection and is therefore under control.
2. At the concentrated energy centers a proper grouping and distant spacing of conductors of like phase will entirely eliminate the possibility of an interphase short.
3. The widely separated phases of the bus should have energy-limiting reactors at points just ahead of the convergence of its tributaries.
4. Energy-limiting reactors are depended upon to exclude all disturbances due to trouble originating outside the station. The theoretical pre-eminence of the reactor as a protective device justifies the responsibilities thus centered upon it.
5. This type of structure could be easily modified to include the additional factor of safety of the semi-outdoor type of switch house by omission of certain walls.
6. An element of safety is introduced by the elimination of the disconnecting operation within heavy-duty breaker or bus chamber.
7. The presence of a minimum number of men is required in the breaker chamber for repair and inspection work at times when the hazard is greatest.

over existing switch houses of the conventional design —actually less than is required by some.

The general scheme of the distant-phase bus system is realized in its entirety when reactors are installed on the generator leads at the bus injunction, in which

The line grouping, as shown in Fig. 5, has given all the operating flexibility required over a period of years in two other Commonwealth Edison central stations where the sub-systems served were diverse in character but severe in reliability requirements. The

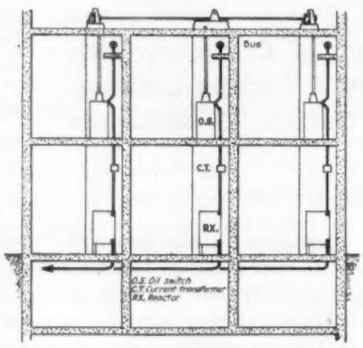
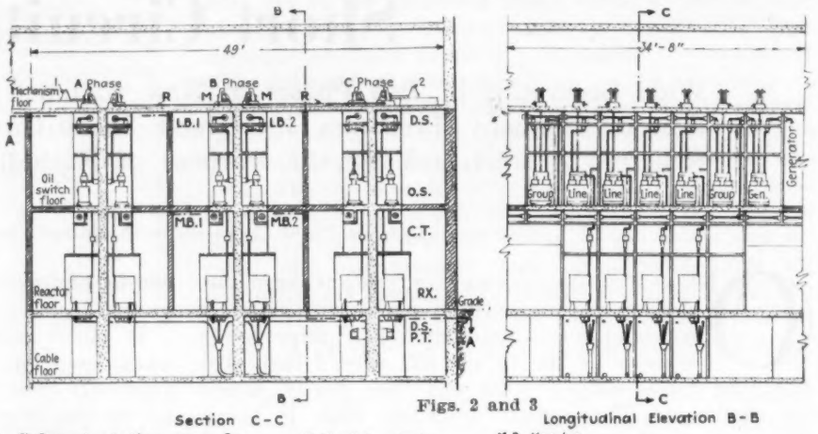


Fig. 1.



Figs. 2 and 3

Fig. 1—Simplified arrangement upon which Calumet station was designed, all switch poles in one row belong to the same phase. Figs. 2 and 3 — Calumet switch-house arrangement provides for extreme spacing between phases. Oil circuit breakers are of the truck type, permitting removal for inspection and repairs. This reduces the time that men must spend in the breaker chamber following system disturbances when hazards are the greatest. Similar apparatus is placed on one floor.

M Oil switch mechanism
R Oil switch control rod
L.B. Line bus
O.S. Oil switch
C.T. Current transformer
M.B. Main bus
D.S. Disconnecting switch
P.T. Potential transformer
RX. Reactor

FIGS. 1, 2 AND 3—NEW TYPE OF SWITCH-HOUSE CONSTRUCTION THAT PREVENTS INTERPHASE SHORT CIRCUITS BY REARRANGEMENT OF PHASES WITH WIDE SPACING BETWEEN

case there is no proximity of phases on any of the tributaries of the bus except beyond energy-limiting reactors. In other words, the widely separated phases of the bus should have energy-limiting reactors at points just ahead of the convergence of its tributaries in order to realize in the fullest measure the essential safety possible with this system.

Attention is directed to the simplicity of the generator bus and line interconnections (Fig. 5) accommodated by this structure, to the fact that each floor has a distinct function, and also to the essential symmetry of the three main interior walls, each of

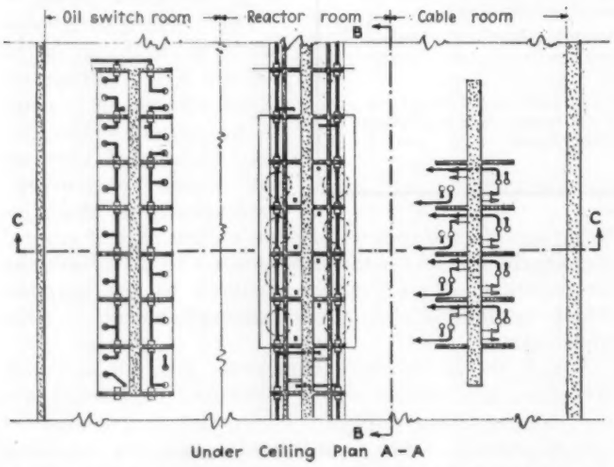


FIG. 4—UNDER-CEILING PLAN FOR FIGS. 2 AND 3, FOR THREE FLOORS OF SWITCH HOUSE

which carries like phases of the duplicate bus system. This proximity, without loss of effective isolation, makes possible in a great measure those economies of the space factor which might otherwise count adversely in the design.

sectionalizing of the bus—a basis of three 30,000-kw. units contemplates ultimately two 100,000-kva. sections, each capable of serving approximately thirty-two lines ranging in capacity from 5,000 kva. to 9,000 kva. Note that the units from a switching standpoint are generators, groups of lines and sections of main buses. No effort has been made to establish the conventional composite unit combining a certain number of line groups with one generator.

On the top or switch mechanism floor mechanism 1 (Fig. 2) controls breakers operating on bus 1 and mechanism 2 those operating on bus 2, the remote mechanical control being transmitted through rods *R1* to parallel motion mechanism *M1*.

A type of mechanism which will eliminate this remote-control feature and drive directly from the top of each phase group of switches is also being developed.

Another feature of the mechanism *M* is its control of the disconnecting switches *DS*, located as shown. A selective manually operated lever gives the operator complete control at this point of the "disconnects" or enables their automatic operation by the breaker mechanism. Another element of safety is introduced, namely, the elimination of the manual disconnecting operation within heavy-duty breaker or bus chambers.

Disconnecting switches are of the double-throw type, the extreme position making a ground connection for the conductor attached to the moving element. This action is possible only while "disconnects" are under manual control and is suitably protected against maloperation. Semaphores at the breaker mechanism will denote the position of the "disconnects."

In the breaker chamber are the line group buses, the disconnects *DS* and the oil breakers *OS*. Breaker elements *OS* are of a truck type to facilitate removal to a shop for inspection and repairs. This reduces the necessity of the presence of men in this chamber for such purposes and at times when the hazard is greatest

—usually following some disturbance which has weakened the system or station equipment.

In the reactor chamber are the through buses *MB1* and *MB2*, current transformers *CT* of the single-bar primary type and the energy limiting reactors *RX*, which are depended upon to exclude all disturbances due to trouble originating outside the station. The theoretical pre-eminence of the reactor as a protective device justifies the responsibilities thus centered upon it.

Beyond the reactors in the cable room where convergence of phases occurs are the line "disconnects" and the potential transformers (open type). These "disconnects" are also controlled from the upper mechanism floors by the operator, or automatically. These "disconnects" complete, in connection with those at the bus, the isolation of the indoor section of the line with all its apparatus (except potential transformer) from all sources of potential.

How Design Might Be Adapted to Semi-Outdoor Construction

In the construction of the building great care has been taken to minimize structural steel or iron, as experience has shown that its proximity to a possible source of an arc greatly increases the seriousness of the possibilities ensuing. Under conditions which would warrant, this type of structure could be easily modified to include the additional factor of safety of the semi-outdoor type of switch house. This is apparent if switch-room floor and walls, shown hatched in Figs. 2 and 3, are omitted or modified. Such an arrangement would still leave the operating mechanisms properly protected from the elements.

Other advantages incident to this type of bus structure are the broad survey of the mechanism room floor which is possible from one point, the increase in the self-protective character of the bus system due to the added reactance of the distant phase arrangement, and also lessening of short circuit stresses on adjacent reactors under some conditions. Other interesting features such as the actuating and safety mechanisms of the oil breakers will be described in future articles covering the plant in detail.

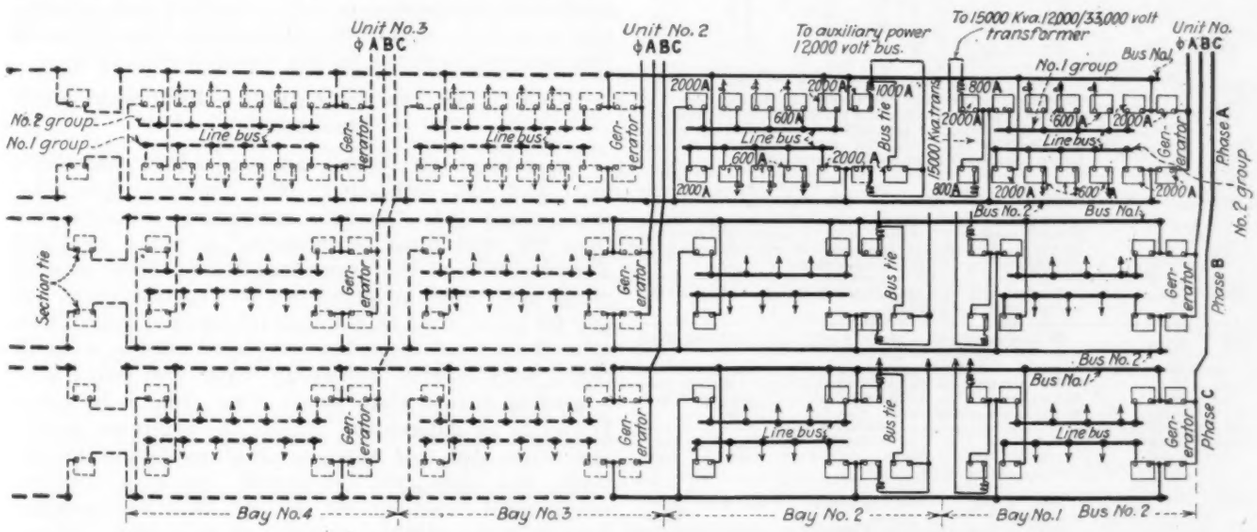


FIG. 5—LINE GROUPING AS DEVELOPED FROM PRACTICE IN TWO OTHER COMMONWEALTH EDISON GENERATING STATIONS

Details are omitted from phase B and phase C wiring for simplicity. It is evident that phases B and C are replicas of phase A wiring.

State Regulations on the Use of Electricity in Coal Mines Increasing*

Uniformity in Codes Would Be Helpful to Electrical Development—Care Should Be Taken Not to Impose Burdensome Restrictions

By L. C. ILSLEY
Electrical Engineer United States Bureau of Mines

THERE is an increasing tendency in the coal-mining states toward the enactment of legislation regulating the use of electrical equipment in the mines. The attitude that the lawmakers take in any state with respect to such revision will have a direct bearing on the economical production of coal in that state. Unwarranted restrictions with respect to electrical equipment upon the statutes of any state hamper coal production and impose a penalty upon that state when in competition with neighboring states not thus hampered.

Well-considered regulations add to the progress of the electrical industry and tend toward safety and economy. The nearer the different states come to reaching a common basis in their regulations the better it will be for all concerned. The manufacturer of electrical mine equipment will be benefited since he will not be under the necessity of building machinery to meet the requirements of several states. Those states having similar enactments will benefit for two reasons: First, having the same kind of regulation, the same outlay for electrical protection will be necessitated, at the same relative cost per ton of coal mined; second, the manufacturer of electrical mining equipment, having to meet the requirements of one code instead of several codes at variance with each other, will need to supply fewer types and therefore can furnish these at a lower price.

Adequate state inspection is necessary if the greatest benefit of the code is to be realized. Any one who has

*Published by permission of the Director United States Bureau of Mines.

spent any considerable time about coal mines realizes the great need in this respect. State inspection can be provided for in three ways—first, by making provision for state electrical inspectors; second, by the employment of properly qualified persons to operate under the direction of the state mine inspector, and, third, if there be such men available, by the appointment of inspectors who are qualified for electrical inspection as well as for the many other duties required of a mine inspector.

INSPECTORS OF EQUIPMENT SHOULD BE QUALIFIED

State mine inspectors are usually selected because of their knowledge of mining and are qualified neither by technical training in electrical engineering subjects nor by practical experience to act as expert inspectors of electrical equipment. Thus frequently they may not recognize real electrical hazards and are often misled as to the true cause of electrical accidents. An example illustrative of non-technical reports came to the writer's attention through the investigation of a fatal accident in a coal mine. The press report of the accident was that the lightning struck a railroad track leading into the mine, followed one of the steel rails about 60 ft. inside the mine to where four men were standing, killed one of the men and shocked two others. As a matter of fact, the lightning struck and splintered a nearby tree above the point where the men were, followed down its roots, continued through crevices of the rock and passed to ground through the man who was killed.

TYPE OF REGULATIONS GOVERNING USE OF ELECTRICAL EQUIPMENT IN COAL MINES

State	Voltage Classification — Low — Alternating Current	Low — Direct Current	Medium — Alternating Current	Medium — Direct Current	High — Alternating Current	High — Direct Current
Alabama	240	300	240–480	300–600	Above 480	Above 600
	No apparatus or conductors carrying a high voltage shall be allowed in or about working places. Portable apparatus using high voltage is prohibited. Electrical equipment installed after April 18, 1911, shall not use any voltage higher than low in or about working places.					
California	300	300	300–450	300–650	Above 650	Above 650
	No higher than medium voltage shall be used underground, except for transmission or for application to transformer, motors or other apparatus in which the whole of the high-voltage circuit is stationary.					
Illinois	Trolley wires and other exposed electric wires shall not carry a voltage above 275.					
Kentucky	In new installations positive conductors carrying more than 300 volts shall be insulated.					
Ohio	No voltage in excess of 650 at switchboard shall be used underground. No voltage in excess of 325 shall be used in or about a working place.					
Pennsylvania (bituminous)	300	300	650	650	Above 650	Above 650
	Same as California.					
Utah*	300	300	650	650	650–4,000	650–4,000
	No higher voltage than 4,000 will be permitted underground until all the plans for the installation of the equipment and its wiring have been first approved by the Public Service Commission in writing. No higher voltage than 650 shall be used underground, except for transmission or for application to transformers, motors or other apparatus in which the whole of the high-voltage circuit is stationary, and no bare signal wires shall be used that carry over 50 volts. After the adoption of these orders, no higher voltage than 275 shall be installed underground, except as above noted, or as extensions to existing electrical systems which are at present permitted.					
Washington	300	300	600	600	Above 600	Above 600
	Same as California, with additional provisions that in gaseous mines high-voltage transmission cables shall be installed in intake airways only.					

* Utah has a fourth voltage classification, termed "extra high voltage," for voltages above 4,000.

All electrical rules, regulations and laws relating to the use of electricity in coal mines have as their aim one or more of the following objects: To prevent persons or animals from receiving an electric shock, to prevent mine fires, to prevent accidents caused by explosives, to prevent mine explosions, to prevent other accidents that may be due to the use of electrical equipment, and to prolong the useful life of the apparatus.

At present twenty-one states make some reference in their coal-mining laws or regulations to the use of electricity or to the operation of electrical equipment. Four states—California, Pennsylvania, Washington and Utah—have enacted laws that embrace more than 50 per cent of the subjects that should properly be covered in an electric code for coal mines. Other states have electrical regulations but have not shown the same progress.

The question of voltage classifications and voltage restriction is of prime importance and should be considered with deliberation by those preparing electrical mining codes. Too drastic voltage regulations practically legislate electricity from the mine, while lax and ineffective regulations permit dangerous and questionable practices. At present eight states have dealt with this question as shown by the accompanying table.

VOLTAGE RESTRICTIONS SHOULD BE CAREFULLY CONSIDERED

The voltage restrictions tabulated afford examples of good and bad legislation. For instance, Kentucky's requirement that "positive conductors carrying more than 300 volts must be insulated" is not a good rule. The kind of insulation is not specified. Neither weatherproof nor rubber covering can be depended upon over any period of time as a safeguard against shock. Moreover, if too much dependence is placed upon such insulation a false security will result which may bring about a greater hazard than would come from a bare wire known to be dangerous. Again, the reference to positive wires does not cover alternating-current installations and does not adequately cover a two-wire ungrounded direct-current circuit. Ohio has seemingly hampered the mining industry in that state unnecessarily through its voltage restrictions. When properly installed, high-voltage alternating-current circuits can be brought into mines with reasonable safety. There are many instances where the saving of copper by the use of high voltage is a large item and where it would pay the operator to go to considerable expense in installing safe high-voltage circuits rather than purchase this additional copper. In other words, the danger does not necessarily depend upon the voltage used. One cannot say that 650 volts is safe and that 660 volts is dangerous. A carelessly installed 650-volt circuit may be much more dangerous than a properly installed 2,300-volt circuit. It is evident also that it would be permissible to use higher voltage on stationary motors than could be used with equal safety on portable equipment.

The question of supervision of electrical equipment is one that has as yet had very little attention in state mining regulations. This is to be expected since the introduction of electrical equipment has been so rapid that the regulations have not had time to catch up with electrical development. A large proportion of the mines using electrical equipment have it in such quantities and

variety that it becomes an economic necessity to have its installation and maintenance carefully supervised.

Only one state—Pennsylvania (bituminous)—has such a requirement in force, and since this seems a well-considered regulation, it is quoted in full: "At every mine where electricity is used below ground for power there shall be employed a competent mine electrician who shall have full charge of the electrical apparatus in the mine but shall be subject to the authority of the mine foreman."

PERIODIC INSPECTION IMPORTANT

Several states now require a certain amount of periodic inspection of electrical equipment, but no state as yet has adequate regulations relating to this point. The reason for such inspection is readily acknowledged when proper consideration is given to its nature and scope.

Parts such as commutators, brushes, bearings and controller contacts deteriorate by wear and should be repaired or replaced before the apparatus has been damaged. Dirt, grease and coal dust accumulate and if not removed may cause grounds or short circuits. Oil and battery electrolytes evaporate, leak out, become dirty and lose their mechanical and electrical effectiveness. Insulation deteriorates with continued exposure to heat or dampness, and grounds and short circuits result.

Falls of roof, wrecks, timbering and blasting cause damage to apparatus and circuits. Protective apparatus, such as relays, circuit breakers, fuses, headlights, signals and bells, need to be carefully maintained.

The following suggested rule is one that might be used to cover inspection:

"At each mine where electricity is used underground a systematic inspection of all wiring and equipment shall be made at regular intervals, at least once every month. A report of each inspection shall be made by the mine electrician or inspector, and a copy of this report shall be furnished to the mine foreman and kept on file at the mine. The report shall definitely state the condition of each main and branch power and lighting circuit and of the motors and controlling appliances of each locomotive, mining pump, hoist or other piece of electrical apparatus connected to the electrical system of the mine."

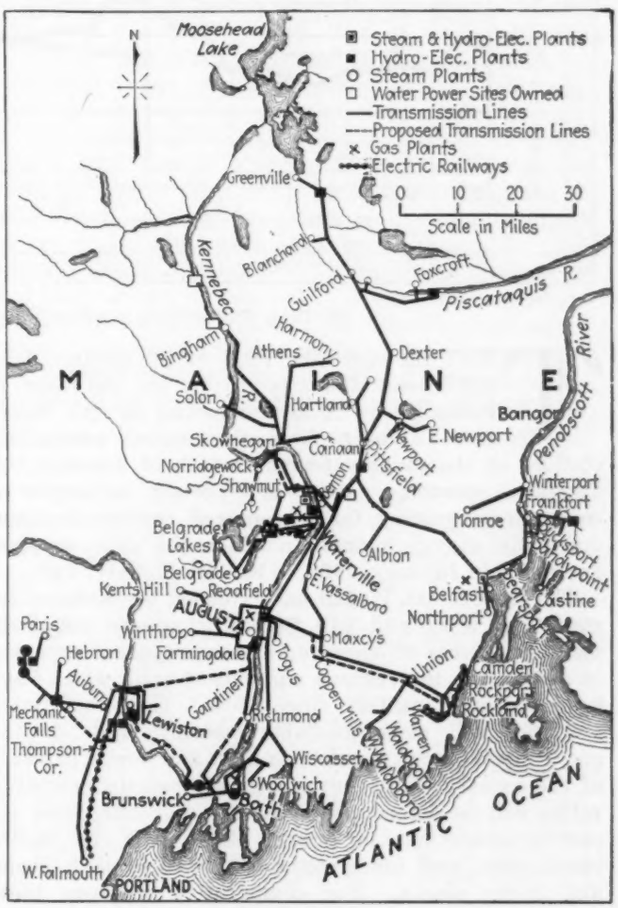
Better Refractories Needed for Electric Furnaces

THE increased demands on the refractories used in electric furnaces have about reached a point where advances in the design and use of furnaces are said to be held back by the shortcomings of the refractories. No doubt many of the difficulties can be met and solved by improvements in present methods of molding and burning refractories. Thus higher calcining temperatures and finer aggregates will undoubtedly help in minimizing slag corrosion difficulties and might possibly increase the life of silica bricks used in roofs. Nevertheless, there seems to be room in this field for the introduction of new refractory materials having new physical and chemical properties to supplement and occasionally replace materials now in use.

It is expected that zirconia minerals, now being produced on a commercial scale and made into refractory shapes, will be of distinct value in the electric furnace field. Zirkite, for instance, possesses nearly all the fundamental requirements for any of the parts of an electric furnace. Its melting point is such as to fit it for use in hearths or in side walls, and especially at the slag line, but for roofs zirkite alone would probably make bricks too heavy to give satisfactory results for all types of furnaces. This information from the research laboratories of the Foote Mineral Company was presented before the Columbus meeting of the Electric Furnace Association.

Central Maine System Serves 12,000 Square Miles

AS A result of the acquisition by the Central Maine Power Company of the Androscoggin Electric Company and other utilities, to form an organization with $17,500,000 aggregate capitalization, the combined system, illustrated by the accompanying map, will serve a territory about 120 miles (192 km.) long by 100 miles (160 km.) wide, extending from Greenville,

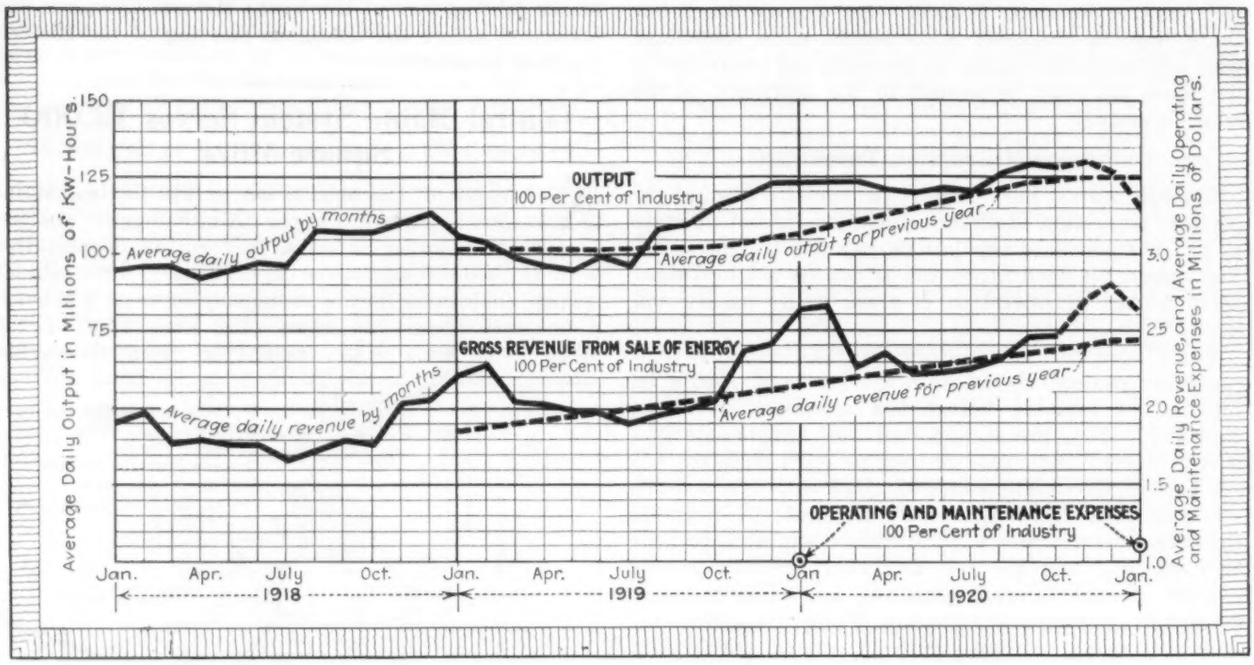


MAP SHOWING COMBINED SYSTEM OF CENTRAL MAINE POWER COMPANY

Me., to the outskirts of Portland, and from Norway to Castine.

By a tie line to be built between Gardiner and Lewiston the plants of the Androscoggin, Kennebec, Piscataquis and Messalonskee Rivers will be interconnected, and other lines will tie together the Lewiston-Bath-Augusta sections as shown. Improved service will be afforded the Rockland district by a new line from Maxcy's to Rockland. The central location of the new hydro-electric station now under construction at Skowhegan will enable all parts of the system to benefit from the capacity that will be available at that point.

Operating Ratio Decreasing



CENTRAL GENERATING STATIONS REPORT DECREASED OUTPUT DURING JANUARY

THAT the operating ratio of the electric light and power industry is on the decrease is indicated by returns received by the ELECTRICAL WORLD from the central generating stations of the country for the month of January. A decreased operating ratio was especially noticeable in companies reporting for a combined system of steam and hydro-electric plants, in which the ratio dropped from 46.5 in January, 1920, to 38.7 in January, 1921.

The ELECTRICAL WORLD has extended the scope of its statistical work and will hereafter receive regularly monthly returns of operating and maintenance expenses in addition to the revenue and output data, which have been reported monthly since 1914. These additional statistics will make available monthly study of the operating ratios of the electric light and power industry of the country. For convenience of analysis, operating ratios will be determined separately for companies reporting operations for steam plants only, for hydro plants only, and for systems composed of both steam and hydro plants. For comparative purposes these ratios will be given for each section of the country.

Operating and maintenance expenses for January, exclusive of interest, taxes, depreciation or sinking fund, are estimated at $34,550,000, and the gross revenue from sale of energy at $81,750,000. The output during January decreased very materially under that of December, the average daily output decreasing to 115,000,000 kw.-hr.; but this figure is still larger than the output reported in November, 1918, which marked the high point in war-time industrial activity.

Another remarkable fact is that although the output for January was 4.8 per cent less than that reported in January, 1920, yet the gross income for January was 16.8 per cent greater than that for the same month in 1920.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1920 Thousands	1919 Thousands	Per Cent Increase
Feb.	69	2,494,764	1,986,493	25.3	63	$45,881	$37,502	22.1
Mar.	70	2,698,890	2,103,587	28.0	65	46,155	36,840	25.0
April	70	2,603,692	2,098,559	24.1	65	45,547	36,541	24.5
May	70	2,631,560	2,179,916	21.2	65	43,888	35,512	23.4
June	71	2,630,831	2,175,645	20.2	66	44,434	35,528	24.5
July	71	2,677,131	2,234,215	20.0	66	46,608	36,265	28.5
Aug.	71	2,769,175	2,303,099	20.1	66	47,410	36,713	29.1
Sept.	71	2,734,179	2,327,460	17.4	66	49,224	38,209	28.5
Oct...	71	2,797,625	2,499,488	11.9	66	51,370	41,055	25.1
Nov.	71*	2,741,705	2,503,402	9.6	66*	54,620	44,711	22.0
Dec.	71†	2,800,418	2,648,892	5.7	66†	57,422	48,456	18.5
		1921	1920			1921	1920	
Jan.	76‡	2,707,234	2,844,616	—4.8	70‡	57,186	49,021	16.8

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1921, Thousands of Dollars	1920, Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1921	Steam Plants 1920	Hydro Plants 1921	Hydro Plants 1920	Combined Systems of Steam and Hydro 1921	Combined Systems of Steam and Hydro 1920
Jan.	36	12,417	11,194	11.0	56.3	55.5	26.8	27.0	38.7	46.5

* Includes estimates for thirty-five companies, representing 4.6 per cent of the total installed rating of all central stations.

† Includes estimates for fifty-six companies, representing 11.3 per cent of the total installed rating of all central stations.

‡ Includes estimates for eighty-four companies, representing 17.6 per cent of the total installed rating of all central stations.

Every section of the country showed a material decrease in output under that of December. The New England States appear to have been the first to feel the revival in industrial activity. There were numerous resumptions of textile mill activity during January, 1,350,000 more spindles being in operation than were reported in December. A revival of activity in the boot and shoe industry and other industries of this section

was also apparent. Because of the advancing season a decreased lighting load was reported, but the New England States returned a smaller decrease below December in total electrical energy output than any other section.

In the Atlantic section the United States Steel Corporation was reported as working at near capacity during January, but the independent steel mills were working at only about 12 per cent capacity in the Mahoning Valley and at 35 per cent capacity in the Philadelphia district. Textile mills were operating at about 35 per cent capacity, although the South Atlantic States reported several textile mills to be resuming full operation. The Southern Pine Association reported that the lumber mills were operating 51.5 per cent below usual. These large industrial curtailments are reflected in a decrease of 12 per cent in the output of the electric light and power stations of that district under the December output.

The independent iron and steel mills in the North Central States were operating at between 30 and 40 per cent capacity during January, and other large manufacturing industries, such as the milling and shoe industries, reported between 50 and 60 per cent curtailments below normal. A decrease in average daily output from 39,500,000 kw.-hr. in December to 35,600,000 kw.-hr. in January resulted from these and other industrial curtailments and from the reduced lighting load.

Marked decrease in drilling activities in the oil fields of Texas, Oklahoma and Kansas, as well as a continued industrial depression throughout the South Central States, contributed to the 8 per cent loss in electrical output in that section below that of December. Mining activities in the Mountain States were heavily curtailed during January, and the Pacific States reported many large industries operating in most cases at less than 50 per cent below normal. The output of the electric light and power stations in the Mountain and Pacific States, while some 7 per cent below that of December, was still slightly above that reported in January, 1920.

Nearly complete returns indicate that the total output of the central generating stations of the country for 1920 was 45,678,000,000 kw.-hr., and the gross revenue from sale of energy during the same period was $882,750,000. The output in 1919 was estimated at 38,878,000,000 kw.-hr., indicating an increase of about 17.5 per cent during 1920. The gross revenue in 1919 was estimated at $773,000,000, indicating an increase of about 14.2 per cent during 1920. A study of the operating ratio figures indicates that the operating and maintenance expenses of the electric light and power generating industry during 1920, exclusive of interest, taxes, depreciation or sinking fund, was about $354,500,000.

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO ELECTRICAL WORLD

Type of Generating Plant	New England States	Atlantic States	North Central States	South Central States	Mountain and Pacific States
Steam Plants:					
Operating ratio—Jan., 1921...	54.0	53.5	61.5	54.0	69.0
Operating ratio—Jan., 1920...	60.8	50.9	62.1	54.7	60.5
Hydro Plants:					
Operating ratio—Jan., 1921...	26.5	21.2	25.0	26.4	28.4
Operating ratio—Jan., 1920...	35.2	21.2	20.8	20.1	27.9
Combined System of Steam and Hydro Plants:					
Operating ratio—Jan., 1921...	45.3	45.3	42.8	38.6	35.0
Operating ratio—Jan., 1920...	53.5	48.1	44.8	46.6	45.5

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Pct. of Installed Ratings Represented	New England States 1920 Thousands	New England States 1919 Thousands	New England States Per Cent Increase	Pct. of Installed Ratings Represented	Atlantic States 1920 Thousands	Atlantic States 1919 Thousands	Atlantic States Per Cent Increase	Pct. of Installed Ratings Represented	North Central States 1920 Thousands	North Central States 1919 Thousands	North Central States Per Cent Increase	Pct. of Installed Ratings Represented	South Central States 1920 Thousands	South Central States 1919 Thousands	South Central States Per Cent Increase	Pct. of Installed Ratings Represented	Pacific and Mountain States 1920 Thousands	Pacific and Mountain States 1919 Thousands	Pacific and Mountain States Per Cent Increase
KW.-HR. OUTPUT	Feb.	82	187,264	148,103	26.2	62	809,865	672,836	20.1	73	858,939	663,523	29.4	56	130,473	98,098	33.0	79	508,223	403,933	26.1
	Mar.	82	198,603	148,512	33.7	64	897,327	711,828	26.0	74	913,659	711,761	28.1	56	137,306	102,545	33.6	79	551,995	428,941	28.6
	April.	82	187,174	144,922	29.1	65	883,264	701,778	25.9	74	857,467	687,751	24.7	56	135,140	99,877	35.2	79	540,647	464,231	16.7
	May	82	188,566	148,186	27.5	65	854,631	711,276	20.0	74	862,127	700,095	23.5	56	137,779	98,815	39.2	79	588,457	521,544	12.6
	June	82	189,934	149,607	26.5	66	865,714	721,688	19.9	74	855,013	681,780	25.5	56	132,733	99,660	33.2	79	587,437	522,901	12.2
	July	82	190,668	159,000	20.0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30.1	79	614,934	551,959	13.4
	Aug.	82	194,028	171,002	13.5	66	905,170	728,097	24.2	74	891,712	750,787	18.6	56	147,082	111,573	32.0	79	631,183	541,640	16.5
	Sept.	82	194,730	170,593	14.1	66	905 872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	113,649	30.0	79	607,816	526,464	15.5
	Oct.	82	196,310	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	583,068	522,136	11.7
	Nov.	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
	Dec.	82	210,591	227,395	-7.5	66	973,701	916,657	6.2	74	905,943	851,910	6.4	56	141,103	134,366	5.0	79	569,080	517,715	10.0
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	198,325	247,440	-19.6	77	1,005,565	1,037,367	-0.3	73	806,422	864,161	-7.0	65	150,603	149,675	1.7	81	546,319	545,973	0.1
REVENUE			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Feb.	82	$5,354	$4,368	22.1	61	$17,245	$14,343	20.4	55	$13,191	$10,403	26.0	53	$2,949	$2,360	24.7	79	$7,142	$6.028	18.3
	Mar.	82	5,136	4,044	27.0	63	17,696	14,299	23.7	57	13,270	10,469	26.5	54	2,910	2,287	27.8	79	7,148	5.741	24.2
	April.	82	5,087	3,943	29.0	64	17,700	14,383	23.5	57	12,690	10,042	26.9	54	2,952	2,181	35.2	79	7,118	5.992	19.2
	May	82	4,897	3,741	30.1	64	16,624	13,631	21.9	57	12,471	9,853	26.8	54	2,829	2,140	32.0	79	7,067	6.147	15.1
	June	82	4,948	3,778	30.5	65	16,525	13,449	22.1	57	12,412	9,776	26.9	54	2,849	2,127	33.9	79	7,700	6.398	20.5
	July	82	5,009	3,802	28.5	65	16,899	13,438	25.5	57	12,822	9,793	30.9	54	2,747	2,194	35.0	79	9,131	6,948	31.5
	Aug.	82	5,075	4,093	24.0	65	17,210	13,731	25.9	57	13,497	10,151	32.9	54	3,168	2,281	38.1	79	8,460	6,457	31.1
	Sept.	82	5,409	4,296	25.9	65	18,081	14,456	24.5	57	13,834	10,522	31.5	54	3,262	2,386	36.5	79	8,638	6,549	32.0
	Oct.	82	5,675	4,623	22.7	65	19,201	15,722	22.0	57	14,458	11,667	23.9	54	3,504	2,551	37.3	79	8,532	6,492	31.5
	Nov.	82	5,898	5,017	17.5	65	20,938	17,119	22.2	57	15,158	12,561	20.8	54	3,853	2,910	32.4	79	8,775	7,104	23.5
	Dec.	82	6,548	5,743	14.0	65	22,373	19,145	16.8	57	15,619	13,125	18.9	54	3,770	3,012	25.2	79	9,112	7,431	22.8
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	6,439	6,200	3.8	74	22,490	19,046	18.1	59	14,584	12,771	14.1	64	4,238	3,513	20.6	81	9,435	7,491	25.8
OPERATING EXPENSES:																					
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	33	$1,077	$1,260	-14.5	43	$5,194	$4,523	14.8	21	$3 119	$2 583	20.6	33	$904	$807	12.0	54	$2,123	$2,021	5.0

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Lighting for Dusty Places

To the Editor of the ELECTRICAL WORLD:

SIR: In the Jan. 22 issue of the ELECTRICAL WORLD Messrs. Dows, Fox and Blackwell made some interesting observations on the illumination of dusty places. However, from my experience I cannot agree that the marine type of fixture solves the difficulty. The coal-grinding plant of a cement mill presents one of the most difficult illuminating problems I have encountered. In four or five days dust will accumulate on an open lamp in sufficient quantity to cut off all the light, and it will be impossible to tell whether the lamp is burning or not. This applies to "Mazda C" lamps up to 300 watts. While this dust is highly inflammable, I have been unable to note any occasion where actual ignition occurred from this source. With other types of coal ignition would probably occur. The vapor-proof fixture will accumulate this dust coat as rapidly as the open lamp. Thus, while increasing safety, it does not remove the necessity for cleaning. The wire guard adds to this cost, and it appears that the dust will accumulate more quickly with this guard than without it.

By a process of elimination we have attacked this problem from another angle. We started with the assumption that the dust settled from above, and we used a flat-cone enameled reflector. This improved matters somewhat. A ventilated-hood, deep-bowl type was then tried as we were afraid of the confined heat in the closed type. The current of air passing through the top resulted in a quicker coating of the lamp than when exposed with no reflector. This gave the key to the whole situation as being purely a matter of air currents around the lamp. By preventing the air currents we can prevent the accumulation of dust on the lamp. Since that time I have made several installations with the deep-bowl RLM enameled reflectors under these conditions and have found that a cleaning once a month will give excellent results.

The one-piece reflector with the socket mounted inside the top usually gives the best results, it being more nearly air-tight than other types. My theory is that by creating an air pocket of dead air the dust-laden air can be prevented from entering. This will prevent any accumulations on the lamp or reflector. The dust will accumulate, however, on the inside of the bottom rim for a width of one to two inches. In an attempt to prevent this a glass was placed over the bottom of the reflector. An accumulation started at the circumference and gradually worked toward the center.

Fair results can be attained with angle reflectors by using a very deep type and a smaller lamp than the reflector design calls for. Here, again, the dead air space remains clean while the other portion soon becomes coated with dust. T. H. ARNOLD.

El Paso, Tex.

Life Tables and Extraordinary Replacements

To the Editor of the ELECTRICAL WORLD:

SIR: There is a need for public utilities to work out a method of setting aside out of earnings annuities to cover replacements on a more reasonable basis than at the present time. The principal questions involved in such a consideration are the life tables of the various portions of the physical plants of the utilities, the recognition of the effect of obsolescence and inadequacy, and the element of what might be termed rapid or extraordinary replacements.

Any life table must take into some consideration obsolescence and inadequacy because, for example, a monolithic concrete structure, such as a diversion dam, may continue in existence for upward of two hundred years, but life tables generally specify a much shorter period than that, thereby recognizing obsolescence or inadequacy. The question is, how far should obsolescence and inadequacy be considered. Some tables give dams as having a life of one hundred years, although recently the life of such structures has been considered as only fifty years, while line distribution transformers are specified at twenty years, rather than ten years, which appears more reasonable.

There is, therefore, a need for a uniform life table and a uniform acceptance of the degree of obsolescence and inadequacy and agreement as to the extent of the element of special replacements which must be considered.

By special replacements is meant where a normal life period may be given, as, say, fifteen years for a transmission line, but, owing to unusual circumstances, a substantial transmission line may be rebuilt because of the discovery that the insulators used are rapidly deteriorating or that a more recently designed insulator can be more economically operated. In some instances an unanticipated industry might develop in a certain territory served by such a transmission line so that it would become necessary to exchange a conductor, which, in turn, would make it necessary to provide a different type of insulator support, cross-arm, etc., all but the poles being thus replaced. This is an expense which cannot be entirely capitalized as a betterment, but it is one which should be charged off over a longer period than one year or less, the ordinary operating period. J. M. BUSWELL.

San Joaquin Light & Power Corporation,
Fresno, Cal.

Checking Meter Connections

To the Editor of the ELECTRICAL WORLD:

SIR: In your Feb. 26 issue, page 487, there appeared an item entitled "Meter Installation Which Permits Easy Check on Connections," by Albert R. Thomas of the Southern California Edison Company. I wish to call your attention to the fact that the method of checking connections proposed is not infallible. The method recommended was discussed in my paper before the American Institute convention of June, 1916, and is published on page 133 of Vol. 35 of the *Transactions* of the Institute.

The paper in question shows that this check fails to differentiate between the correct connections and certain incorrect connections. (See page 201 of the volume referred to.) WILLIAM B. KOUWENHOVEN,
Johns Hopkins University, Associate Professor.
Baltimore, Md.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Standardization of Meter Leads Is Desired

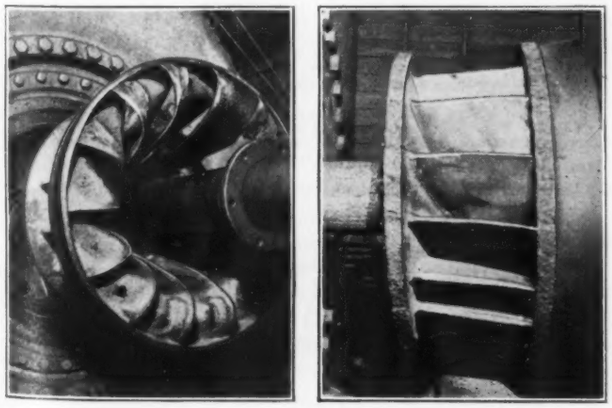
RECOMMENDATIONS on the position of meter leads, the fastening of meter disks to the shafts and the interior painting of meters were made at the Miami convention of the N. E. L. A. The recommendations were a summary of opinions of member companies of the Southeastern Section. This summary was given in the meter committee's report.

In this report standardization of the method of bringing out the leads of polyphase meters was strongly recommended. The committee urged that the potential leads be on the outside of the meter, near the ends, and the current leads adjacent to each other on the inside. It was generally thought that the interior of meters should be painted white to facilitate inspection. More care, it was held, should be taken in selecting and applying paint to the frame and base to prevent the paint peeling off and stopping the meter disk. This trouble had been experienced by a number of companies.

Alabama Power Company, S. A. FLETCHER,
Birmingham, Ala. Superintendent of Service.

Repairing Waterwheel Runner by Electric Welding

REPAIRING a worn waterwheel runner by electric welding was found to add 350 kw. to the power available from an old 3,000-kw. wheel in the Naches power house of the Pacific Power & Light Company, near Yakima, Wash. This is a 36-in. Victor turbine built by the Platt Iron Works Company. It is directly



WATERWHEEL BEING REPAIRED BY ELECTRIC WELDING

At left—Runner with some of the holes in the vanes closed up. At right—Clearance rings and shaft built up ready to be turned.

connected to a 3,000-kw. General Electric alternator. The runner on this unit is of bronze, and several months ago serious pitting took place so that the discharge ends of the vanes were pitted clear through and the bases of the vanes pitted so that one broke out, cracking several others before the machine could be brought to a standstill. A thorough examination was made, and it was found that the clearance on the discharge end of the runner was 0.22 in., while on the opposite end it was 0.14 in. These clearances were too great.

At first it appeared that it would be necessary to junk the runner. However, electric welding was tried and 168 lb. of bronze was used to build up the runner where it had been pitted and also at the clearances. The clearance rings were then removed and machined true, after which the runner was put in a lathe and the clearance machined to proper size. The vanes were smoothed by means of a small electrically driven emery wheel and finished off with files by hand where possible. The shaft also was built up and machined to size. A test showed that the power of the station was increased 350 kw. by the changes. The average clearance on the exhaust end of the runner was 0.025 in., and on the head end, 0.033 in.

Pacific Power & Light Company, J. H. SIEGFRIED,
Pasco, Wash. Superintendent of Power.

Numerous Advantages Possessed by Secondary Networks

SOME of the advantages of a secondary network over individual transformer installations are enumerated as follows: (1) It permits the use of a few large transformers instead of a large number of small ones, and the iron loss per kva. is less for large transformers than for small ones. (2) Large transformers cost less per kva., and hence the investment charge is reduced. (3) By taking full advantage of the diversity factor the total required transformer kva. is materially reduced, thereby reducing iron loss. (4) For the same reason the investment charge is reduced. The principle is the same as when station generators are operated in parallel. (5) Reduced resistance loss results for equal copper investment, because the maximum demands do not occur on the same section of secondary at the same time. (6) The energy saving due to distributing at 230 volts, three-wire, instead of 115 volts, two-wire, makes possible the distribution over a given area with the same copper and much smaller resistance loss. (7) Better voltage regulation results, because each customer is served from two or more directions. (8) Better continuity of service is secured, because each customer is served from two or more transformers.

For the successful operation of a secondary network it is most important that each transformer be sectionalized from the others by means of a secondary sectionalizing switch, which should be installed at approximately the neutral load point between any two or more transformers. There have recently been developed very satisfactory switches for this purpose. Caution, however, should be exercised not to insert a sectionalizing switch in the grounded neutral wire of a transformer secondary. In the event of failure of any transformer primary fuse, the secondary sectionalizing switches will, immediately upon overloading, dis-

connect the transformer from service, and only that section within the radius of this transformer will be inconvenienced by an interruption of service. By encouraging the customers to report immediately any interruption to their service or any dimness of their lights a trouble man can quickly be sent out.

In banking transformers together great care should be taken to see that they are of the same make, type and ratio. If the characteristics of two banked transformers are not the same or nearly so, they will not divide the load properly.

THEODORE H. RICE,
Operating Department.

Henry L. Doherty & Company,
New York, N. Y.

Heavy Equipment Transported Over Steep Mountain Roads

PRACTICALLY all the equipment for the 50,000-hp. Kerckhoff plant of the San Joaquin Light & Power Corporation was hauled along difficult mountain roads over a route about 5 miles long and which contained sharp turns and a maximum grade of 12 per cent. This plant was described in the ELECTRICAL WORLD for Feb. 26, page 471.

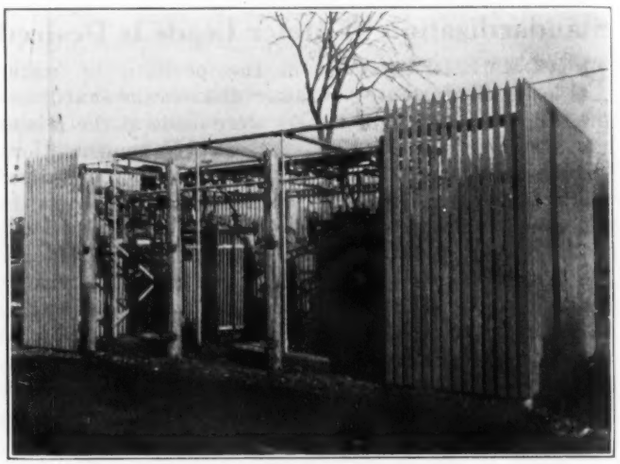
The total weight hauled was 33,300 tons, of which 8,000 tons was a back haul of salvaged rails and lumber, supplies and equipment. The equipment used in hauling the material consisted of one 75-ton Holt caterpillar tractor, one 45-ton Holt caterpillar tractor, six 10-ton Holt double-end trailers, one 35-ton Holt trailer, three 5-ton Mack trucks, three 5-ton two-wheel trailers, one 5-ton White truck and seven 2-ton White trucks. All express and mail service was maintained with three Dodge commercial-type cars. All of this equipment rendered a satisfactory and economical service. R. C. Starr is the company's construction engineer.

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Materials Required for Standard Outdoor Transformer Installation

TO FACILITATE the construction of outdoor transformer installations, a standard layout for these has been developed by the engineering department of the Worcester (Mass.) Electric Light Company. A 1,000-kva. layout is shown herewith. The transformers are mounted on 4-in. channel-irons resting on a rein-



STANDARDIZED OUTDOOR TRANSFORMER INSTALLATION FOR 13,200/675 VOLTS

forced-concrete platform 6 in. deep, with a cinder foundation 12 in. deep. Over all the platform measures 16 ft. 8 in. by 6 ft. 4 in. A three-phase, 13,200-volt cable from the underground or overhead system of the company is carried to a pothead at the top of a frame built of 1½-in. iron pipe. From the pothead No. 4/0 solid rubber-covered wire leads are carried to disconnecting switches and thence to the buses, which are supported on insulating clamps carried on the pipe

MATERIAL FOR A STANDARD 1,000-KVA. TRANSFORMER STRUCTURE, 13,200 TO 675 VOLTS

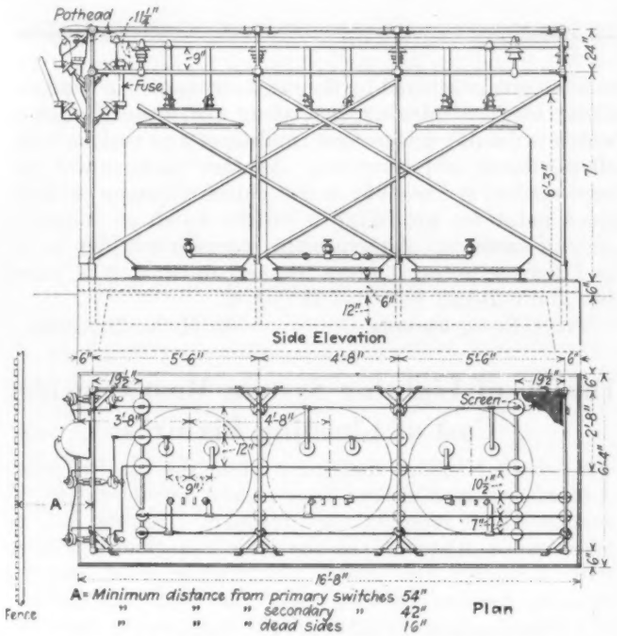
Six 16-ft. x ⅝-in. reinforcing rods.
Eight 2-in. galvanized iron pipes 2 ft. long.
Eight 1½-in. black iron pipes 10 ft. long, R.H. thread one end.
Eight 1½-in. black iron pipes 5 ft. 2 in. long, one R.H. and one L.H. thread.
Two 1½-in. black iron pipes 5 ft. 2 in. long, two R.H. threads.
Eight 1½-in. black iron pipes 5 ft. 4 in. long, two R.H. threads.
Four 1½-in black iron pipes 4 ft. 6 in. long, two R.H. threads.
Two 1½-in. side outlets ("L"s), three R.H. threads.
Two 1½-in. side outlets ("L"s), two R.H. threads, one L.H. thread.
Two 1½-in. side outlets ("T"s), four R.H. threads.
Two 1½-in. side outlets ("T"s), three R.H. threads, one L.H. thread.
Two 1½-in. side outlets ("Ts"), three R.H. threads, threads on run removed.
Two 1½-in. side outlets ("T"s), two R.H. threads, threads on run removed.
Two 1½-in. side outlets ("T"s), two R.H. threads, threads on run removed.
Two 1½-in. side outlets ("T"s), three R.H. threads, threads on run removed.
Four 1½-in. side outlet clamps, E.E.E. Co., No. 1634.
Eighteen bags cement.
3½ yd. gravel (run of bank).
2 yd. sand.
Twelve screen supports, 2-in. x ¼ in. 14 in. long.
Two braces, 3 in. x 1¾-in. angles, 5 ft. 7½ in. long.
Four braces, 2 in. x ¼-in. angles, 7 ft. 6½ in. long.
Four braces, 2 in. x ¼-in. angles, 11 ft. 11½ in. long.
Forty-six U bolts made up of ½-in. stock with nuts.
One 1½-in. diamond-mesh screen ⅜-in. L. No. 10 wire, 5 ft. 1 in. x 4½ ft.
One 1½-in. diamond-mesh screen ⅜-in. L. No. 10 wire, 5 ft. 1 in. x 5 ft. 3 in.
One 1½-in. diamond-mesh screen ⅜-in. L. No. 10 wire, 5 ft. 1 in. x 6 ft. 6 in.
Three 333-kva. single-phase self-cooled Pittsburgh transformers, with taps for 13,200-12,870-12,540-12,210-11,880/575 volts.
Fourteen Delta-Star insulators, type VUO, catalog number 72,003.
Eleven Delta-Star insulators, type VUO, catalog number 72,201.
Three G.E. clamps, catalog number 131,949, 2 in. x ½-in., with bolts.
Six G.E. clamps, catalog number 123,352.
Six G.E. clamps, catalog number 123,353.
Nine G.E. clamps, catalog number 174,465.
Nine G.E. clamps, catalog number 174,466.
Twenty-seven galvanized bolts, ⅜-in. x 2 in.
Eighteen galvanized bolts, ⅜-in. x 1½-in.
Four galvanized bolts, ½-in. x 2-in.
15 ft. No. 4/0 solid rubber-covered, D.B. 13,200-volt wire.
Three Delta-Star outdoor fuse mountings, type G-2, catalog number 63,205.
Three Delta-Star outdoor disk switches, type G-2, catalog number 63,120.
Three 200-amp. S. & C. fuses, Delta-Star, catalog number 10,761.

Busbar Copper
1½-in. x ¼-in., two 13 ft. long, one 9 ft. 9 in. long, and two 2 ft. 9 in. long.
2½-in. x ⅜-in., two 14 ft. 6 in. long, one 11 ft. 3 in. long.
2½-in. x ¼-in., two 9 ft. long.

One Pothead type 30, No. 304 E.E.E. Company.
Twelve fence posts, 13 ft. 6 in. long.
Eight spruce fence rails, 2 in. x 4 in., 5 ft. long.
Five spruce fence rails, 2 in. x 6 in., 4 ft. 8 in. long.
Two spruce fence rails, 2 in. x 4 in., 4 ft. 8 in. long.
Two spruce fence rails, 2 in. x 4 in., 11 ft. 2 in. long.
Two spruce fence rails, 2 in. x 6 in., 11 ft. 2 in. long.
Two spruce fence rails, 2 in. x 4 in., 7 ft. 2 in. long.
One spruce fence rail, 2 in. x 4 in., 3 ft. 0 in. long.
Two spruce fence rails, 2 in. x 4 in., 16 ft. 4 in. long.
One spruce rail, 2 in. x 6 in., 16 ft. 4 in. long.
Two spruce fence rails, 2 in. x 4 in., 8 ft. 4 in. long.
One spruce fence rail, 2 in. x 6 in., 8 ft. 4 in. long.
Three spruce fence rails, 2 in. x 4 in., 3 ft. 4 in. long.
220 spruce pickets, 1 in. x 2½ in., 9 ft. 6 in. long.
Twelve angles, 3 in. x 2 in., 9 in. long.
Twenty carriage bolts, ½ in. x 2½ in.
Twenty-four wood screws, ½ in. x 6 in. long, No. 40.
Ten lag bolts, ½ in. x 6 in., special.
Ten washers, ½ in.
Three 10-in. x 2-in. strap hinges.
One 6-in. loop.
One padlock.
10-lb. No. 8 nails.
5 lb. 6-in. spikes.
½ gal. red lead.
3 gal. gray paint.

framing at the top of the structure and directly above the transformers. The 13,200-volt buses are spaced 12 in. apart horizontally and at one side, and in the same horizontal plane are mounted the secondary buses, carrying 675 volts.

The secondary buses are spaced 7 in. apart, and from these the necessary feed is made to the customer,



LAYOUT OF STANDARD 1,000-KVA., 13,200/675-VOLT TRANSFORMER STATION

usually by underground cable. The material required is shown in the table on page 770. A diamond-mesh screen mounted above the buses protects the service from possible interruption due to foreign bodies striking the buses.

In estimating costs labor is taken as about 7 per cent of the total cost of material.

F. L. LOVETT,
Distribution Engineer.
Worcester (Mass.) Electric Light Company.

Motor on Waterwheel-Driven Exciter Saves Power and Shutdowns

THE water necessary for continuously driving a spare exciter represented an undesirable loss in the Mill Creek No. 3 station of the Southern California Edison Company. This exciter is for use only in case the small nozzle of one impulse-type waterwheel-driven exciter should become plugged. As this station operates under a head of 1,900 ft. each second-foot of water represents considerable energy and at times of low water is quite valuable. To save this loss it was decided to equip one of the exciters with an induction motor on the opposite end of the shaft from the waterwheel and float the motor on the station bus so that when the waterwheel was operating the motor would act as an induction generator and supply some energy to the bus, thereby utilizing a small amount of water that might otherwise be wasted at times when the whole output of the waterwheel was not needed for furnishing power for excitation.

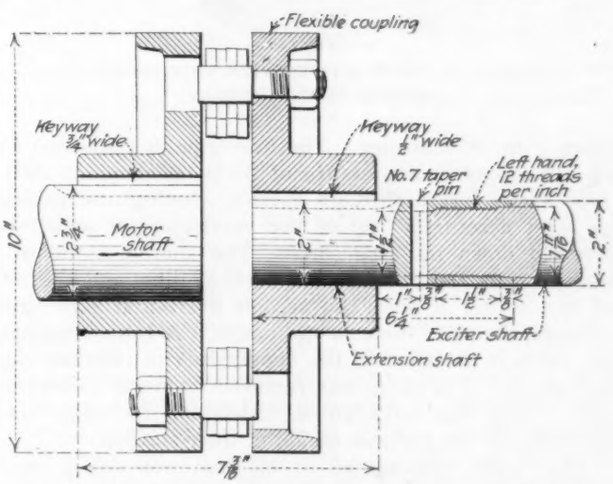
It was desirable to place a flexible coupling between the motor and exciter, but, as the shaft of the exciter ended flush with the outer edge of the bearing, it was necessary either to make a new shaft for the exciter and waterwheel, with an extension long enough for mounting the coupling, or to devise an extension for the existing shaft. On account of the high cost of the former method and the difficulties which would be encountered in using it, the latter method was decided upon, and this was accomplished as illustrated in the drawing.

A male and female threaded joint was used. The dimensions of the hollow shaft and the solid shaft were proportioned to give the same torsional strength. The exciter shaft in the bearing was 2 in. in diameter. The shaft extension was made of 2⅛-in. cold-rolled shafting. This extension was fitted in place to the exciter shaft, tightened, and an 1/16-in. hole was drilled through the shaft at right angles to its axis and through the plane of contact of the shaft and its extension. This hole was then reamed through with a No. 7 taper-pin reamer and then reamed from the other end to a depth of ⅜ in.

A No. 7 taper pin 2½ in. long was driven into the hole and beaded in the small end of the hole. The extension was then trued up to the same diameter as the exciter shaft, a keyway was cut and a flexible coupling mounted for connection to the motor.

This coupling has been in successful operation for about three years under varying load conditions from full load as a motor to about half full load as an induction generator. This range of load is obtained with a speed variation of about 5 per cent. The rated speed of the exciter set is 1,050 r.p.m., and the synchronous speed of the motor is 1,000 r.p.m. Under certain operating conditions the output of this motor operating as an induction generator is greater than the energy required for station light and power, and the meter measuring the load is run backward. The exciter is rated at 35 kw. and the motor at 50 hp.

If the nozzle of the waterwheel becomes plugged, the motor automatically picks up the load when the speed



THREADED SHAFT EXTENSION SAVED COST OF NEW SHAFT

of the exciter falls below the synchronous speed of the motor.

A considerable saving of power has been effected by the installation of this motor.

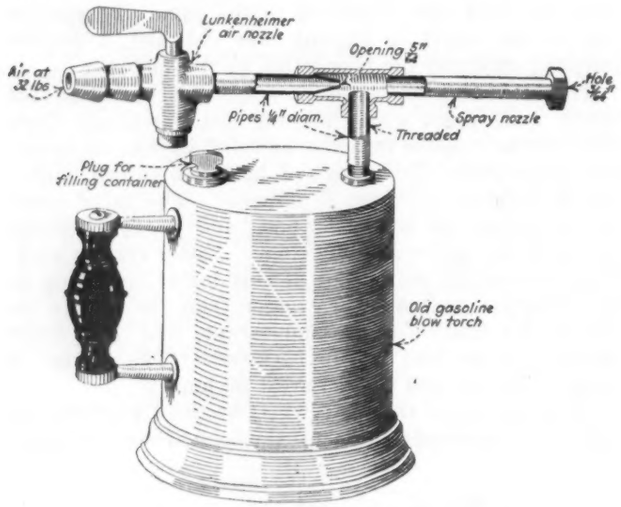
J. W. ANDREE,
Assistant Superintendent of Generation.
Southern California Edison Company,
Los Angeles, Cal.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Air Brush Made from Old Torch for Applying Insulating Paint

FOR applying insulating varnish to windings of motors which have been repaired and for other painting work an air brush has been made by the writer from an old gasoline blowtorch. By means of this brush the paint is thoroughly applied into all crevices, and painting is done about five times as fast as with the ordinary hair brush. To make the brush the burner was removed from the torch and a nozzle was inserted for spraying the paint. This nozzle is made of three



INSULATING PAINT APPLIED WITH THIS AIR BRUSH ENTERS SMALL CREVICES

pipes ¼ in. in diameter. The first pipe is connected to an air supply at a pressure of 35 lb. per square inch. This air is forced through a 5/64-in. opening and passes as a jet across the top of the vertical pipe, which is screwed down into the torch. The suction thus produced raises the paint in the vertical pipe, and the jet of air forces it into the second horizontal pipe and through the ¼-in. hole in the nozzle. A Lunkenheimer air valve is installed in the supply line to regulate the flow of air. The pump was removed from the blowtorch and a plug was substituted which can be easily unscrewed for the purpose of filling the container.

The nozzle opening of ¼ in. has been found very satisfactory for all the grades of paint which have been tried. These include a No. 913 "imperial compound" (Canadian General Electric Company), which is used for general insulating and preservative purposes. Its brilliant surface is of great durability on iron work of all kinds, and it is air-drying. A glossy finishing varnish of the Westinghouse Electric & Manufacturing Company has been successfully used. This is an oil-proof insulating varnish which dries quickly. Another varnish manufactured by the same company is a medium-glossy black, air-drying, insulating and protective paint which is flexible under most conditions and resists acids, alkali, fumes and moisture. Another paint which has been applied successfully is switchboard lacquer, a dead-black paint for producing a velvety finish on rough or smooth surfaces. Although this varnish will dry in air in fifteen minutes, it gives the best finish if it is baked two and one-half hours at 35 deg. C.

Trail, B. C., Canada. R. H. N. LOCKYER.

Design of Lighting System Must Consider Cost of Cleaning Fixtures

IN DESIGNING a lighting system the cost of maintenance should always have careful consideration. A system which requires very frequent cleaning may be much more expensive in the long run than a system with a higher first cost. The frequency of cleaning lighting fixtures depends upon the following factors: (1) Illumination required; (2) illumination provided by clean equipment; (3) type of fixture; (4) design of fixture; (5) materials of fixture; (6) cleanliness of the air; (7) season of the year; (8) method of cleaning.

The illumination required is determined by the sort of work to be done in the light produced by the system. The smaller the margin between the illumination required and the illumination provided the more frequently will the lamps and reflectors or other fixtures have to be cleaned.

The shape of the fixture largely determines the amount of dust and dirt it will catch. From the point of view of cleanliness only, the ideal shape is of such design that there is no exposed upward transmitting or reflecting surface lying anywhere near the horizontal. This is obtained in the direct-lighting reflector, but it is not commonly found in the semi-indirect fixture and never in the indirect.

Except for one shape (RLM standard) the design of lighting fixtures has not yet been standardized. The design largely determines the amount of light lost by cross-reflection and absorption. There are on the market automatic cut-out hangers which enable the usual industrial reflector to be lowered to the floor for cleaning. When for any reason the use of such an arrangement is impossible (as with the lamps in the roof trusses over traveling cranes) fixtures may be used of such design that the dirty reflector can be detached and a clean one put in its place without disturbing the socket or mountings.

The materials in the fixture determine to some extent the light absorption and the degree to which the dirt in the air will adhere to the surfaces, as well as the difficulty which will be met in its removal. Some materials cannot be washed as clean as they originally were, and some turn yellow with age. The amount and the character of the dirt in the air and its adhesive

qualities differ, of course, in different cities, locations and industries.

In the winter cleaning may have to be done more frequently owing to the shortening of the days and the increase in the amount of dirt collected. As the days become shorter the difference between the illumination available (including the natural light) and that required becomes smaller.

There is no longer any excuse for installing a lighting system without a careful illumination design having first been made. If an illuminating engineer cannot be retained, any large lamp or fixture manufacturer will gladly draw up his design free of charge on receipt of the required information. D. W. BLAKESLEE.

Pittsburgh, Pa.

Close Inspection Insures Good Motor Service

CLOSE inspection of motors, depending in frequency upon their location and the character of service they perform, has been a vital factor in the maintenance of production with few interruptions from motive-power troubles at the factory of the Seymour Manufacturing Company, Seymour, Conn. In this plant 179 motors are installed and operating, totaling 3,058 hp. and ranging in size from "fractionals" to 500 hp.

If the motor is installed in a clean location and is not used continuously, it may not require inspection or oiling more than once a month. But if it is in a hot, dirty place, with perhaps a heavy belt pull, it may be blown out and oiled weekly. Air-gap testing depends on the motor service. If the motor is belt-connected or geared to the driven equipment, air gaps are inspected every fortnight and in some cases weekly. Extreme care is used in watching air gaps and replacing worn bearings before any harm has been done to the motors. Direct-connected motors are not watched so closely, since these give almost no trouble. The motors are divided into two sections, with a man in charge of each section who is held strictly responsible for operating results. These men oil the motors, and in case a motor becomes dirty they make arrangements to have it blown out, cleaned and the windings revarnished and perhaps painted. The inspections require on the average one full day of ten hours for two men each week. Instruction sheets are not used to check inspections. If a motor is in good operating condition, no report is made, but if repairs are necessary, the inspectors report and make preparations for such work. More than 95 per cent of the motors are three-phase, 440-volt, 60-cycle machines, and of these about 10 per cent are slip-ring motors, the rest being of the squirrel-cage type. No dollars and cents record of motor maintenance is kept.

Up to about Jan. 15 the company employed five men who, in addition to motor maintenance, handled all new installation work and change-overs of all electrical equipment in the factory, besides having care of transformers, lamps, meters, clock, autocall and fire-alarm systems, looking after six electric trucks equipped with alkaline batteries, and being charged with the maintenance of all cranes and hoists.

SUBDIVISION OF MOTORS TOTALING 3,058 HP., WHICH ARE INSPECTED PERIODICALLY

No. of Motors	Size, Hp.	Sets of Bearings Carried	No. of Motors	Size, Hp.	Sets of Bearings Carried
1	500	1	10	15	2
2	250	1	25	10	5
1	200	1	33	7½	6
1	150	1	36	5	7
2	75	1	20	3	4
2	50	1			
2	40	1	5	2	1
5	30	1	5	1	1
10	25	2	16	Fractional	..
3	20	1			

The company does not rewind motors, having found that it does not pay to keep supplies and equipment for this purpose in view of the small amount of work required. Only five motors have burned out in the past four and one-half years, and these were all 15 hp. or below in rating.

On motors of above 50 hp. the company does not make a practice of carrying spare bearings unless the motor is operating under hard service in a dirty location. Then it is considered safer to carry one set for each size. As the plant is within 16 miles of New Haven, a large jobbing center, it is unnecessary to carry as much spare material as would be the case in a more remote situation. A fair average of spare bearings carried for smaller motors is about one set for every five motors. For slip-ring motors one set of brushes is carried in stock for each size and a new set is ordered when these are drawn. On controllers for slip-ring motors so many different sizes are used in the plant that no spare parts are carried in stock. These controllers, however, are closely watched and new parts are ordered well in advance of wearing out, and of course promptly in case of burn-outs. Spare parts would be carried if enough controllers of one size were in use in the factory.

Motors of 7½-hp. ratings and below are equipped almost exclusively with small oil switches, and for these the company carries about one complete set of switches and fingers for every fifteen oil switches. This has proved sufficient because it is seldom necessary to change a whole set, and usually only one or two of a

MOTOR RECORD

NAME PLATE DATA — MANUFACTURER General Electric Co. — H.P. 5
SERIAL No. 1362342 — VOLTS FREQ PHASE 440-60-3 — R.P.M. 900
TYPE FORM ETC. K.T.-181-8-5-900-B — AMPS 7.8
DATE RECEIVED 1-9-19 — PRICE $200.00

Iron Pulley 4½ face 4½ diam 1⅝ bore — LOCATION

FROM	FLOOR	TO	FLOOR	DATE	REMARKS
		Main Mill	1	1-9-19	Driving Press Cutter
Main Mill	1	Stock		5-6-19	
Stock		Main Mill	1	8-27-19	Driving Water Pump
Main Mill		Motor burned out from overload from sticky pump, someone had replaced standard fuses for fuses with too large capacity.		10-30-19	Sent to N.H. Elec Co. for repair
		Stock		11-22-19	Returned repaired Cost $3.10
Stock	1	Sitting Room		7-29-10	Perkins Shears

STARTING OUTFIT
SERIAL No. 1184621
DESCRIPTION Oil Switch
General Electric Co
Type P10

REPAIR PARTS
BEARINGS #128518
BRUSHES
Coil Spec 138271F

RECORD FORM WHICH GIVES THE HISTORY OF A MOTOR THROUGH ITS VARIOUS LOCATIONS AND REPAIRS

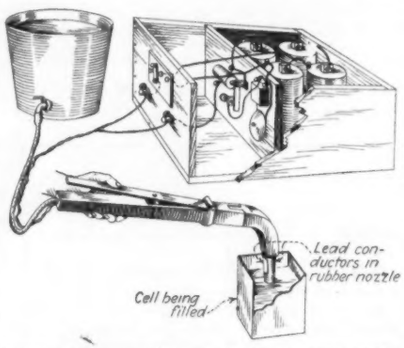
set. On compensators about the same proportion as on oil switches is followed. As oil switches are constantly in use, at least four are generally carried in stock in order to replace any broken ones.

Motor records are kept on cards about 5 in. x 8 in. in size, as shown. Data relative to make, size, speed, type, etc., are kept, with notes on the number and type of starter used, repair parts with manufacturer's number, and pulley data. Space is provided on each card to show the location and duty of each motor, and transfers from one location to another are indicated, with dates of repairs (when required), period in stock and dates of withdrawal for later service.

L. N. BURHOE,
Electrical Engineer.
Seymour Manufacturing Company,
Seymour, Conn.

Filler for Storage Batteries Indicates When Proper Level Is Reached

WHEN storage batteries are being filled by means of the device shown in the accompanying drawing the ringing of a bell announces that the level of the electrolyte is at the proper height, and therefore no close watching by the battery man is necessary. Besides this feature, the filler prevents spilling of water on the top of the cells, thus preventing grounds which cause burning of the rubber jars and deterioration of the trays, and it also serves as a check on the specific gravity of the electrolyte, keeping it constant by not allowing more water to be put into the cells than the quantity lost by evaporation. The filler consists of a wooden handle through which soft rubber tubing and insulated wires pass to the rubber nozzle. This nozzle is joined to the lower end of the handle. The end of the nozzle fits into the vent hole in the top of a cell, while a shoulder larger than the hole prevents the nozzle from going too far. Inlaid in the nozzle are two lead conductors attached to the rubber and connected to the two insulated wires which are run through the handle. When the electrolyte in the cell reaches the proper height it short-circuits these two lead conductors, closing the circuit through a relay and a battery of three or four cells, as conditions of the battery may require. The closing of the relay throws the bell into the circuit with the dry cells. When the bell rings the operator cuts off the flow of water by compressing the lever, which has a projection that presses on the rubber tube in the handle and shuts off the flow of liquid.



SHORT-CIRCUITING OF LEAD CONDUCTORS CAUSES BELL TO RING WHEN ELECTROLYTE REACHES PROPER LEVEL

The filler also serves another function. If the gravity of a cell is very low, the bell will not ring until the electrolyte rises to such a height that it overflows the top of the plates.

When the electrolyte is of such a low specific gravity it indicates that the cell is internally short-circuited and should be removed from service.

The function of the switch is to make a circuit of three dry cells when the battery is filled in time and the level of the solution has not been allowed to fall much below the tops of the plates. If, however, the water in the solution has been allowed to evaporate so that its level is much lower than the tops of the plates, or, if for some cause the specific gravity of the electrolyte is very low, the switch is utilized to add the fourth cell to the circuit and thus overcome the increased resistance of the medium through which current must pass, in order to bring about the ringing of the bell when the proper level is reached.

This filler, which is patented, has been used successfully for some time in the vehicle-battery departments of the New York Edison and Consolidated Gas companies of New York City.

A. SHEINAUS,
Fore Battery Man, Auto Department.
New York Edison Company,
New York.

Study of Ratings Makes Possible Reduction in Number of Motor Sizes

BY A CAREFUL consideration of the motor ratings in a plant it is often possible to reduce the number of sizes and types, and consequently the number of spare parts, carried in stock for emergency repairs. It should be realized that no matter how well apparatus is built, how carefully it may be installed and looked after, some of the parts will wear out in continuous hard usage and must be replaced—wherever possible before an actual breakdown occurs. Preparedness in the form of an ample supply of spares and repair parts, which permit quick renewal of defective parts, is therefore wise. But a large stock of such parts, aside from space requirements, involves a large investment. It is for this reason that pressure is exerted by the management upon those in charge of electrical equipment to reduce to a minimum the amount of money tied up in spares and repair parts, and it is in this direction that efforts should be made through standardization of ratings.

TABLE I—STANDARD LIST OF 239-VOLT DIRECT-CURRENT MOTOR RATINGS PREPARED BY ONE PLANT OF THE UNITED STATES STEEL CORPORATION

Open Frame, Constant Speed,		Open-Frame, Adjustable Speed,			Totally Inclosed Frame, Constant-Speed,	
Hp.	R.P.M.	Hp.	R.P.M.		Hp.	R.P.M.
2	1200	2½	1,100	2,200	1½	1,500
3	775	3½	660	2,000	5½	1,150
7½	975	6½	450	1,800	10	975
15	825	18	780	1,560	13	875
20	750	25	600	1,800	18	900
30	725	35	650	1,300	25	900
65	875	50	700	850	...	.....
75	635	75	600	1,200	...	.....
100	500	100	475	900	...	....

Many of the older plants still suffer from past sins of commission or omission and have a veritable museum of makes and types and sizes of motors on their hands. Sometimes, owing perhaps to a natural development, both alternating and direct current are in use and different voltages and frequencies as well.

Further than that, the writer strongly feels that standardizing on a certain rating for motors which shall be used in a certain plant and limiting the number of such ratings as much as possible will result in a great economic advantage to both user and maker. An analysis of conditions at various plants has demonstrated the possibilities along this line. By tabulating the various motors in use as to capacity, speed and

other characteristics it becomes evident in every large plant that a considerable reduction in the number of sizes can be made. This not only results in relieving the spare-parts situation, but also facilitates the shifting around of motors as operating conditions or changing requirements of production may demand.

It has also been found that such standardizing of certain ratings, particularly when several large users of motors get together and agree on a common list of ratings, results in better service and deliveries from

TABLE II—STANDARD LIST OF 230-VOLT, DIRECT-CURRENT MOTORS AND 220-VOLT ALTERNATING-CURRENT MOTORS, PREPARED BY ANOTHER PLANT OF THE UNITED STATES STEEL CORPORATION

Alternating-Current, 220-Volt Three-Phase				Direct-Current, 230-Volt			
				Shunt or Compound Wound		Shunt-Wound Adjustable-Speed	
25-Cycles		60-Cycles					
Hp.	R.P.M.	Hp.	R.P.M.	Hp.	R.P.M.	Hp.	R.P.M.
5	720	5	675	5	1,100	5	400/1 200
7½	725	7½	680	7½	1,150	7½	400/1,200
10	725	10	680	10	1,150	10	400/1,200
20	730	20	685	20	1,100	20	400/1,200
40	725	40	685	30	1,150	32½	400/1,200
50	730	50	690	50	750	50	350/1,050
75	725	75	700	75	635	...	.....
100	725	100	700	100	625	...	.....
150	725	150	700	....	....	...	.....
200	485	200	700	....	....	...	.....

the motor manufacturer, as the latter is then in a position to prepare for the requirements of a customer on the basis of the standard list of selected ratings. The fact that so many different sizes of motors are used in a plant at times is in part due, not to the selection of the ultimate user, but rather of the machine-tool builder, crane or pump manufacturer. In such cases large plants should provide, as a few of them have provided, their suppliers of machine tools and other motor-driven equipment with a list of selected ratings and limit the motors to these sizes.

The above will best be understood by referring to Tables I and II, which show ratings as selected and standardized some time ago by two of the large steel companies. Considering the large number of motors used in these plants and the many different service requirements, the present small number of ratings is remarkable compared with past practice. In selecting the ratings listed particular attention was given to picking out ratings which would result in a minimum number of different mechanical parts or frame sizes. The entire list of twenty-four direct-current ratings, for example, is covered by ten different frame sizes, which therefore required only ten different sizes of bearings.

C. W. STARKER,
Electrical Engineer.

Roth Brothers & Company,
Chicago, Ill.

Proper Combination of Motor and Flywheel Increases Power Factor

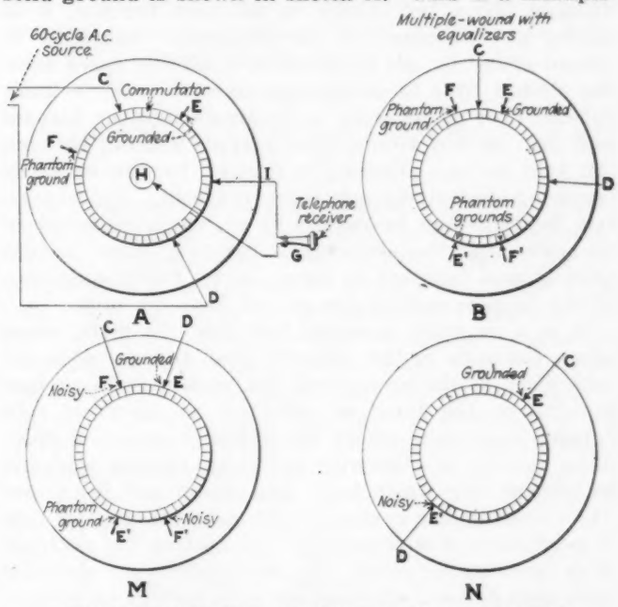
IN PLANTS using shears, punches, rolls and other machines equipped with flywheels the low power factor often caused by overmotoring can be eliminated by a careful study to obtain the best combination of motor and flywheel. In many cases it will be found that the motor installed has sufficient power to perform the duty cycle without the flywheel. In one mill, which had a power factor varying from 40 to 60 per cent, there was found a special welding roll which was driven by a 200-hp. squirrel-cage motor. A heavy flywheel was used, but the motor had only about 2 per cent slip and therefore carried virtually the entire load. This condition lasted only a few seconds out of several minutes, so that most of the time the motor was running idle. By a proper combination of motor and flywheel it was possible to substitute a 50-hp. motor which materially reduced the wattless kva.

C. W. DRAKE,
General Engineer.

Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Locating Solid Ground in Armature

FOR locating a solidly grounded coil of a direct-current armature use may be made of a telephone receiver. Often a coil makes such good contact with the iron of the machine that it cannot be detected by passing direct current from coil to frame and noticing the point where smoke comes out. A machine with a solid ground is shown in sketch A. This is a multiple-



METHOD OF LOCATING A GROUND WITH A TELEPHONE RECEIVER

wound armature without equalizers, having a ground at *E*. Sixty-cycle current is passed through the armature from two opposite points on the commutator, *C* and *D*. The current should be limited by a rheostat to about 5 per cent to 10 per cent of the full-load current of the winding. If one side of the alternating-current line is grounded the motor frame should be insulated from ground while making the test. The armature is placed on horses and the leads of a telephone receiver are connected to the shaft *H* and the commutator. The lead on the commutator is moved around until it reaches bars where the noise in the receiver ceases. These bars will be at *E* and *F*. The bar *F* will be silent because it is at the same potential as *E*. After these two bars are marked the alternating-current leads are attached to *E* and *F*. On testing with the receiver *E* will now be silent and *F* noisy, proving that *E* is grounded.

In a multiple-wound armature with equalizer rings, as shown in sketch B, silent points will first occur at *E* and *F* and at *E'* and *F'*. Then connect leads *C* and *D* at *E* and *F* as in *M*. With this connection *E* and *E'* will be silent and *F* and *F'* noisy. Then connect the

current leads to E and E' (sketch N). Under this condition E' will be noisy and E will be silent, showing the grounded point to be at E. The point always remaining quiet is grounded.

If alternating current is not available, direct current may be used, interrupting it with a knife switch moved steadily in and out for low-resistance armatures or with a buzzer connected in series for high-resistance armatures. The buzzer, or course, should be used on its rated voltage.

F. W. GAY.

Newark, N. J.

Decreasing Electrode Consumption in Electric Furnace

UNWARRANTED oxidation is the most frequent cause of excessive electrode consumption. When this wasteful oxidation occurs under the furnace roof it is known as "spindling" of the electrode. When oxidation occurs only near the furnace roof, or some distance above the charge in an open furnace, it is known as "wasping" of the electrode. Spindling is caused either by the evolution of oxidizing gases from the charge (due to insufficient carbon) or by a leaky furnace door allowing air to be drawn into the furnace and then up and around the electrode and out through the roof ports. Wasping is caused by the electrode becoming excessively hot above the roof. This excessive heating may be caused by an electrical overload so heavy that the electrode is carrying more current than it was designed to carry, or by faulty operation of the furnace making the arc too near the roof.

It is a generally accepted fact that the main waste of an electrode in the ordinary steel furnace does not take place at the arcing end but results from surface burning in the form of spindling as described. In furnace operations where the ordinary causes of spindling cannot be otherwise overcome various attempts to prevent this waste have been made, such as these: (1) Covering the electrode with asbestos coating held in position with wire netting; (2) coating the electrode with non-burning paint; (3) surrounding the electrode with steel collars held together with springs or hinges; (4) surrounding the electrode with a water-cooled collar extending well into the furnace.

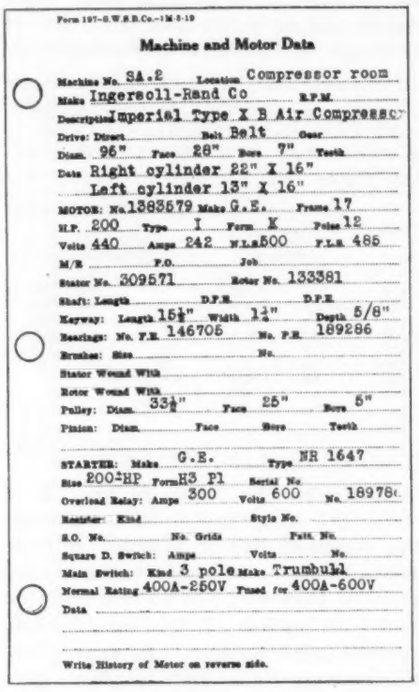
One of the most important factors in insuring minimum oxidation of an electrode is the proper handling of the furnace after it has been shut down. The following suggestions are sometimes heeded as a help in getting lower oxidation upon the stopping of furnace operation: (1) Lute the clearance between the roof glands and the electrodes with fireclay, and (2) before closing the furnace doors place a large piece of soft coal on the sill of each. The heat of the furnace will drive the gas from the coal, producing in the melting chamber of the furnace a non-oxidizing atmosphere in which the electrode may hang for a long time without burning. Care should be used to remove the luting around the electrode upon resuming the operation of the furnace.

If wasping has started on an electrode, it is almost impossible to stop it, and it is advisable to discard the affected electrode. Care should be taken that the support is directly over the center of the roof gland; also that the electrode holder is vertical so as to avoid subjecting the electrode to strain.

The National Carbon Company, Inc., furnished this information.

Machine and Motor Records Aid Speedy Repairs

ONE of the chief aids in keeping track of the equipment, and thereby speeding repairs, in the plant of the Southwestern Shipbuilding Company has been motor and machine records kept on cards and in loose-leaf books. The cards constitute a cross-index for the records in the loose-leaf books. The former are filed according to the motor horsepower. They contain full information on the motor and tell on what machine it is installed. In the loose-leaf books the sheets are filed according to the shops in which the motors are located, the sheets for each shop being filed by machine serial numbers. These sheets contain information on the machine, including data on motor and control equipment necessary for ordering new parts.


Form 197—S.W.S.B.Co.—1M-5-19

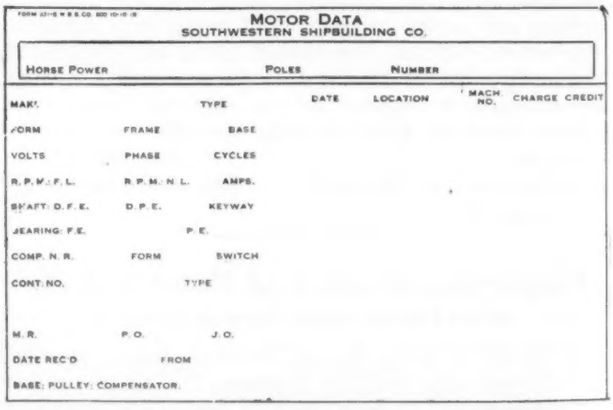
Machine and Motor Data

Machine No. SA.2 Location Compressor room
Make Ingersoll-Rand Co R.P.M.
Description Imperial Type X B Air Compressor
Drive: Direct Belt Belt Gear
Diam. 96" Face 28" Bore 7" Teeth
Data Right cylinder 22" X 16"
Left cylinder 13" X 16"
MOTOR: No. 1383679 Make G.E. Frame 17
H.P. 200 Type I Form K Poles 12
Volts 440 Amps 242 R.P.M. 500 F.L.S. 485
M/R P.O. Job
Stator No. 309571 Rotor No. 133381
Shaft: Length D.F.E. D.P.E.
Keyway: Length 15½" Width 1¼" Depth 5/8"
Bearings: No. F.E. 146705 No. P.E. 189286
Brushes: Size No.
Stator Wound With
Rotor Wound With
Pulley: Diam. 33½" Face 25" Bore 5"
Pinion: Diam. Face Bore Teeth
STARTER: Make G.E. Type NR 1647
Size 200 HP Form H3 P1 Serial No.
Overload Relay: Amps 300 Volts 600 No. 189786
Resistor: Kind Style No.
S.O. No. No. Grids Fuse No.
Square D. Switch: Amps Volts No.
Main Switch: Kind 3 pole Make Trumbull
Normal Rating 400A-250V Fused for 400A-600V
Data

Write History of Motor on reverse side.

SHEET FOR DRIVEN MACHINE GIVES MOTOR NUMBER AND SIZE

The terms and abbreviations used which are not self-explanatory are: M/R, material request form on which material needed is requested from the purchasing agent; P.O., the purchasing agent's orders; Job, the job numbers under which jobs costing over $50 are done; D.F.E. and D.P.E., diameter respectively of front and pulley end of shaft; Bearings No. F.E. and P.E., numbers respectively of front-end and pulley-end bearings; Rotor, or Stator, Wound With, size of wire given.


FORM 321-S W.S.B.CO. 500 10-10-19

MOTOR DATA
SOUTHWESTERN SHIPBUILDING CO.

HORSE POWER POLES NUMBER

MAKE TYPE DATE LOCATION MACH. NO. CHARGE CREDIT
FORM FRAME BASE
VOLTS PHASE CYCLES
R. P. M.: F. L. R. P. M.: N. L. AMPS.
SHAFT: D. F. E. D. P. E. KEYWAY
BEARING: F. E. P. E.
COMP. N. R. FORM SWITCH
CONT. NO. TYPE
M. R. P. O. J. O.
DATE REC'D FROM
BASE: PULLEY: COMPENSATOR:

CARD WITH COMPLETE MOTOR DATA FILED ACCORDING TO HORSEPOWER OF MOTOR

Southwestern Shipbuilding Co.
East San Pedro, Cal.

A. G. HUMPHREY,
Electrical Engineer.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Buffalo Company's Customers Increased 900 per Cent in Past Decade

IN THE accompanying diagram is shown the number of customers connected to the lines of the Buffalo General Electric Company at the end of each year from 1892 to 1920. The number on Dec. 31, 1920, was 85,008, an average of one customer to every six of the population of the city of Buffalo, which the last census gives as 506,775. The diagram shows a remarkably rapid growth in the number of customers from year to year. For the year 1920 the increase is a little more than 30 per cent. It is interesting, however, to compare the increase in customers with the increase in Buffalo's population over the same period. Going back to the 1900 census, the population was 352,387, while the number of electric customers at that time was approximately 1,000—only one customer to every 352 of population. In 1910 Buffalo had a population of 423,715, a 20.2 per cent increase, while electric consumers had increased to about 8,500, or 750 per cent. During the ten years just past the population increased by 19.6 per cent, but in the same period the Buffalo General Electric Company increased its customers by 900 per cent. In other words, the users of electric light and power in Buffalo have increased forty-six times faster than has the city's population.

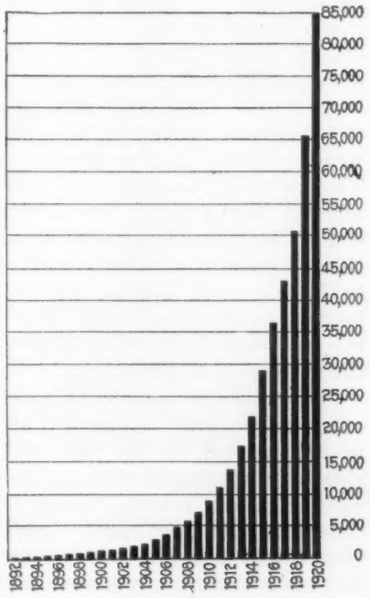


DIAGRAM SHOWING INCREASE IN CUSTOMERS

Equalizing Seasonal Rates for Energy

A METHOD of equalizing seasonal energy rates which has proved remarkably acceptable to the public was described at a meeting of the Commercial Section of the New England Division, N. E. L. A., March 18, by Frank R. Fowles, Cumberland County Power & Light Company, Portland, Me. A heavy summer cottage and hotel business is handled by this company along the southern Maine coastline, and the rate schedule now in force charges the customers of the company 15 cents per kilowatt-hour throughout the four summer months, including both summer and permanent residents. Every customer, however, is allowed to purchase as much energy during the winter season at 5 cents per kilowatt-hour as he purchased at 15 cents per kilowatt-hour during the summer. The remainder of the energy consumed is billed at 10 cents per kilowatt-hour. This arrangement avoids discrimination between summer and year-around customers' bills during the summer season and leads to the carrying of a proper share of the cost of serving these seasonal customers by those who reside in the territory for a short time only.

"The People's Project"—An Address by R. H. Ballard

IN AN address which had for its subject "The People's Project," made at a meeting of the district managers of the Southern California Edison Company in Los Angeles on Feb. 17 last, R. H. Ballard, vice-president and general manager of the company and past-president of the National Electric Light Association, emphasized the fact that the section served cannot reach its highest development and the money for construction needs be obtained except through patriotic co-operation of the people at large with the public utility. In developing this subject he said:

"Public utility service is created for serving the public, which means that every individual in the community which it serves is a patron. The service must be ready at all times to supply all the people with water, gas, electricity, transportation and telephone and telegraph message transmission. Stripped of its legal and technical definitions, a public utility is the servant of all the people. The utilities should be one good lap in advance of the demands of their patrons because, under the conditions of modern life and bearing in mind the conveniences which the people now demand as necessities, no community can grow in advance of the service which the public utilities render.

"Every project which has for its ultimate aim the building up of a domain such as southern California into one of the great centers of the nation's population, and the building up of which multiplies almost beyond mathematical conception both individual and community wealth, should be a project of the people. A better understanding will be reached when the people fully understand that under government and state regulation public utility companies are public agencies and not money-making machines. They function for the public as contractors, providing service at cost. Labor, material, supplies, money and everything that enters into their service must be purchased and accounted for at cost. The state imposes certain duties and obligations for the utility to meet, and the right of the state to regulate involves the obligation to protect.

"To southern California has come a phenomenal growth in industrial and agricultural activities relatively not surpassed in any section of the country, and, in addition, we receive a continual procession of cultivated people who look for and expect the highest form of public service. This has placed upon these public contractors a phenomenal burden, since the demands for service are at least twice those which were expected based on only normal growth. It is their duty, nevertheless, to keep their service ahead of the demand, otherwise those who seek to make their homes in our community might be deterred.

"Think of what is transpiring! It is indicated by all of the public service records—water, gas, electricity, telephones and railways—that the population of Los Angeles alone has increased by 100,000 in the past year. This 17 per cent increase is in contrast with an accumulative increase of 6½ per cent a year during the previous ten years.

"Take the telephone situation as an illustration: Notwithstanding the installation of 9,000 additional phones during the past year, there remain unfilled orders of more than that number.

"What we have virtually done in the last year is to plant another city of 100,000 population on the map of the United States, within our own boundaries, and in a measure this growth has been repeated on a smaller scale in other centers of population in southern California. The unthinking person imagines that the public service company can jump in instantly and fill all the requirements created by this unprecedented growth. The manufacturing facilities of all of the great electric concerns of America could not accept such an order without casting aside the demands of their other customers in Europe and America. At this juncture it is well to remember that the consumption in utilities, and therefore the demand on public service agencies, increases in a ratio much greater than the ratio of increase in population.

INCREASED DEMAND FOR SERVICE

"It was only a few years ago that the supply of gas in southern California was greatly augmented by the bringing in of enormous quantities of natural gas from distant fields at tremendous expense. Nevertheless, both last year and this year, during certain months, we have been confronted with a gas shortage.

"Our street railways have added hundreds of additional cars to their service lines, yet one can hardly find standing room in them through many hours of the day. The water service in Los Angeles has been adequate so fas as the supply of water is concerned, owing to the foresight of those who conceived and carried through the construction of our great aqueduct system; but the cost has been very great and millions of additional funds will be constantly needed for extensions, reinforcement of distributing systems and reservoirs.

"In ten years the population of the State of California increased about 45 per cent, but the electrical output increased more than 300 per cent. During the past year we passed through a power shortage in California that was one of the most critical periods in its history. The electric companies operating in the territory managed to function, although the demand upon them was greatest of all, owing to the exhaustion or greatly increased cost of other forms of energy and the increasing number of uses to which electricity is applied.

"Our steam railroads have recently had their systems thrown back on their hands after the governmental experiment which resulted in enormous increases in operating expenses, many of which were unnecessary, and a deplorable lack of care of the property through insufficient maintenance and inefficient upkeep expenditures. Electrification of the steam railroads is one of the problems which confront the power companies.

HYDRO-ELECTRIC DEVELOPMENT MOST ESSENTIAL

"Without enormous hydro-electric development southern California cannot become the manufacturing and agricultural center which it should be destined to be because of its favorable situation with respect to the world's markets. The realization of its destiny depends upon the enhanced development of hydro-electric energy to provide the motive force for industrial and agricultural purposes and for commercial and domestic uses.

"Because of the diversity of its use, the development of 50,000 hp. of electric energy will provide ample service for 32,250 residences and 300 factories and for the irrigation of 100,000 acres of land. This is, approximately, the present annual increase in demand, to provide for which requires the expenditure of $15,000,000 for power development and distribution, with a consequent expenditure by the consumers of twice that amount for house and factory wiring and in the purchase of motors and installation of thousands of useful and necessary electrical household appliances. Thus $45,000,000 of business is created annually. This, however, is only incidental to the increase in community wealth, population, payrolls and production which follows the development and use of the power. This increase has been capitalized by some authorities at more than $250,000,000 a year. Electrical energy is one of the three component parts entering into the creation of public wealth, namely, products of the soil, brains of man, power. Other sources of power are becoming exhausted, but as long as nature functions and the snows fall hydro-electric power will be available for the service of mankind.

"If we are to continue to grow, then all the people must realize that the public utilities are fundamental necessities and for the most part must be provided considerably in advance of actual needs, since great hydro-electric power plants, railway and telephone systems cannot be built over night. Intelligent, earnest co-operation with those who have studied the utility problems and have scientific assurance of coming demands is the answer to the great question of keeping utilities in advance of our expected necessities and stimulating the growth and advancement of our richly endowed Southland. Fair earning under strict regulation is fundamental if a utility is to provide adequate service and market its securities for construction work.

"To provide these services requires some form of public ownership, and the kind of public ownership which has been proved successful is ownership by the public at large in the securities of its local utility companies operated under rigid state regulation. This forms a partnership which leads to complete understanding and co-operative efforts in development and retains in the management and operation of the utilities those trained by long experience to perform the task. A sound financial showing, backed by such public support, will induce the people in the territories served to purchase the junior securities or stock of our utilities to the extent of, say, one-half of the funds necessary to be secured in financing new development. Automatically, the util-

ity is then placed in a position to borrow the other half in the Eastern money market, by the sale of bonds, and thus a local investment of one dollar insures a local development of two dollars.

"When the people of southern California understand and appreciate that every dollar they invest in the securities of our local public utilities brings additional dollars to be expended in labor, material and merchandise and for the upbuilding of those things which are essential to the doubling and trebling of the population, I do not think that they can fail to see it in the light that I see it—the people's project.

"No longer can it be truthfully said that a public service company is a thing apart, an alien in the community, with interests antagonistic to the general welfare. These public agencies are integral parts of the communities they serve, and especially is this true of those companies whose capital is widely owned by the people who depend upon them for an essential service."

Electric Servantless Apartment

PARTICULARLY appealing to the city dweller who is constantly confronted by the servant problem is an electric apartment recently opened in the Borough of Queens, New York City. A six-room apartment in the Garden Apartments was completely equipped with electrical labor-saving devices and additional floor and wall outlets were provided.

Reproduced here are an exterior view of the apartment building and the kitchen and nursery of the electrical apartment. In the kitchen the following electrical appliances were in operation: Electric range, cooker, dishwasher, cake and dough mixer, refrigerator, washing machine, iron and fan. In the nursery were a milk warmer, miniature electric heating pad, toy electric range, electrically heated toy steam engine, electric boat and suitable nursery lamps.

The equipment of the dining room consisted of an electric percolator, toaster-stove, chafing dish, ovenette, waffle iron, grill and an egg beater and mixer. In addition to the usual table and floor lamps and ceiling fixtures in the living room an electric player piano and an electric phonograph were installed. In one bedroom were an electric heating pad, vibrator, curling iron, radiator and bedside lamp, while in the other bedroom, which was also used as a sewing room, an electric sewing machine, violet ray outfit, boudoir electric iron, headlight heater and electric hair drier were installed.

The electric servantless apartment is being conducted co-operatively by the Queensboro Corporation, builders of the apartment house; the electric appliance manufacturers and one of the leading furniture dealers of New York as a demonstration of how completely servants can be eliminated by the use of electric labor-saving devices.

VIEWS OF THE ELECTRIC SERVANTLESS APARTMENT, SHOWING THE NURSERY AND KITCHEN AND THE EXTERIOR OF THE APARTMENT BUILDING

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

The Story of the Induction Motor.—B. G. LAMME.—This paper covers the history of the technical side of induction-motor development. The various stages are indicated from the early Tesla motor with polar-field construction to the distributed-field construction and from the early wound-rotor type to the later universal cage type. Reference is made to the development of the cage motor with high starting torque and the reasons which led up to it. The early single-phase induction motor is also treated, indicating various stages in its development. The latter part of the paper covers the applications of the induction motors to various unusual services such as heavy mill work, locomotive operation, ship propulsion, etc. The paper refers principally to American practice and primarily to development work of the company with which the writer is connected.—*Journal A. I. E. E.*, March, 1921.

Lamps and Lighting

Removable Fixtures.—A series of discussions dealing with the advantages and practicability of using electrical fixtures of a removable type. The significance of the proposition is outlined by O. H. Caldwell, its relation to better lighting by M. Luckiesh, the fixture man's viewpoint by W. R. McCoy, and how the proposition affects the contractor-dealer by W. J. Shore.—*Transactions I. E. S.*, March 21, 1921.

Merchant Marine Searchlamps.—G. E. YOUNG.—The importance of searchlamps for marine use is evident from consideration of the following uses: (1) Locating man overboard, (2) assisting another ship in distress, (3) passing through wreckage, (4) signaling between ships or between ship and shore, (5) lighting buoys and other navigational marks, (6) lighting docks in landing or during coaling operations. Some elements in the control of searchlamps for marine use are given.—*General Electric Review*, February, 1921.

Generation, Transmission and Distribution

Calculation of Voltage Drop in Three-Phase Transmission Lines.—G. HULDSCHINER.—The voltage drop in three-phase lines is investigated for differently arranged wires, and it is shown that a considerable improvement of the drop (as much as 50 per cent) may be obtained by subdividing the totally required copper cross-section into two parallel lines, carrying half the current each. The mathematical and vectorial deductions are accompanied by an actual example, calculated for each of the four-wire arrangements considered.—*Elektrotechnische Zeitschrift*, Jan. 27 1921.

Coil-End Leakage of Armature Windings of Single-Phase Commutator Motors.—F. UNGER.—No accurate way of calculating the coil-end leakage of so-called direct-current windings is as yet known, owing to the difficulty introduced by the dense interlinking of the coil ends. The author devised a new method giving fairly exact results. A highly mathematical analysis of the new method is given in two installments.—*Elektrotechnik und Maschinenbau*, Jan. 9 and 16, 1921.

Electrical Distribution System for Modern Concrete Factory.—C. P. TRUEAX.—Details of power and lighting installation involved in the construction of a concrete factory. Rigid conduit is laid in concrete during the process of building construction.—*Electrical Review*, Feb. 5, 1921.

Traction

Electric Trucks for the Berlin Suburban Lines.—WECHMANN.—A complete suburban train consisting of twelve coaches is propelled by a front and a rear electric truck controlled from the front platform of the first coach. This has been made possible by the very low height of the truck, which is less than 5 ft. (1.5 m.), and by mounting the pantagraph current collector on the roof of the first coach. The trucks contain a single-phase forced-air-cooled commutator motor of 460-kw. one-hour, or 365-kw. continuous rating, driving by 1:3.54 reduction gear a jack shaft, which in turn is rod-coupled to the two driving axles. Directly above one of the axles is mounted the main transformer of 650 kva. one-hour rating, of the dry, air-blast type, 105 kva. being required for train heating. A 15-kw. fan provides the forced air for transformer and motor. An air compressor rated at 60 cu.m. per hour supplies the brakes, oil switch, pantagraph and the rail sanders. Nine taps on the low-voltage winding of the transformer, two choke coils and two small resistances provide twelve positions of the controller. The main data of the truck are: Weight complete, 34,000 kg.; maximum speed, 65 km. per hour; maximum r.p.m. of motor, 900; drawbar pull at start, 9,600 kg. Under most unfavorable conditions the acceleration amounts to as little as 0.21 mile per second per second. Assuming an average station stop of twenty-five seconds, a shortest train sequence of 100 seconds could be reached, corresponding to thirty-six trains per hour. The illumination of the trains in both types is derived from a small transformer with a 10-volt secondary. This permits the use of heavy-wire tungsten lamps which burn with a steady light in spite of the low frequency of $16\frac{2}{3}$.—*Zeitschrift des Vereines Deutscher Ingenieure.*—Feb. 12, 1921.

Installations, Systems and Appliances

Operating Details of Electric Furnaces.—EDWARD T. MOORE.—Results of a questionnaire reported by the electric furnace committee of the A. I. and S. E. E. which had been submitted to steel manufacturers operating electric furnaces. The data secured indicate that the greatest need at present is for better electrode economy, which may be brought about by watching the handling of electrodes closely, storing them in a warm, dry location and attending to their proper joining. It is said that the improvement of the roof cooling ring will have a large effect on electrode consumption. Lack of tensile strength is also said to be one of the causes of electrode

trouble, and other difficulties due more or less to the methods of charging or handling the material are brought out.—*Chemical & Metallurgical Engineering*, Jan. 26, 1921.

Speed Regulator for Motors Driving High-Frequency Generators.—W. DORNIG.—Customary regulators of, for example, the Tirrill type permit of a regulation of voltage and speed within about 0.5 per cent to 1 per cent. A new type of extremely delicate speed regulator is described, operating relays at a change of speed of as little as 0.01 per cent to 0.002 per cent, the latter being a fineness required for the drive of high-frequency generators in wireless work.—*Elektrotechnische Zeitschrift*, Jan. 6, 1921.

Electrophysics and Magnetism

Some Applications of the Method of Images—II.—C. M. HERBERT.—The author derives the general equation for potential, given by Kunz and Bayley in another paper, directly from Euler's infinite product expansion of the sine, thus avoiding the use of elliptic functions. Equipotential lines and lines of force are shown for two cases, a square and a rectangular tube; also curves giving the fall of potential along certain important lines.—*Physical Review*, February, 1921.

Effect of the Rate of Cooling on the Magnetic and Other Properties of an Annealed Eutectoid Carbon Steel.—C. NUSBAUM and W. L. CHENEY.—Specimens of a eutectoid carbon steel were cooled from 800 deg. C. in air, in lime and at various rates in a furnace. The effect of these rates of cooling on the magnetic properties—viz., maximum and residual induction, coercive force, permeability and the magnetic reluctivity relationship—also on the resistivity and scleroscope hardness, are shown in tables graphically and their significance is discussed. Micrographs illustrating the structure are presented. It is shown that the change in structure from an essentially sorbitic one to "divorced" pearlite causes a gradual shifting of the bend in the reluctivity line and a greater difference between the values of the "real" and "apparent" saturation intensities.—*Scientific Paper No. 408, U. S. Bureau of Standards*, Jan. 22, 1921.

Electrochemistry and Batteries

The Hall Effect and the Nernst Effect in Magnetic Alloys.—ALPHEUS W. SMITH.—In the iron-copper series a maximum Hall effect was obtained with 1.5 per cent copper. The variation with composition is very similar to the variation of electric resistance. In the nickel-copper series the effect reaches a maximum with about 26 per cent copper, when the composition corresponds to the formula $CuNi_4$, and then drops suddenly to a small fraction of its maximum value. In the iron-nickel series, although the effect is positive for iron and negative for nickel, the effect increases linearly with the proportion of nickel added to iron until for 13 per cent nickel it is six times as great as for pure iron. In certain alloys the variation of the effect with field strength is anomalous, the effect being negative for weak fields and positive for strong ones. An explanation based on the theory of Borelius is suggested which assumes that in addition to the positive part of the effect which is proportional to the field strength there is a negative part which reaches a limiting value for strong fields. Concerning the Nernst effect in magnetic alloys it is said that in the nickel-copper series the effect varies with the composition in nearly the same way as the Hall effect. In the iron-nickel series the effect decreases with the addition of nickel, becoming zero for about 2.2 per cent nickel and positive for higher concentrations. With 13 per cent nickel the effect is about five times as great as in pure iron.—*Physical Review*, January, 1921.

Units, Measurements and Instruments

A New Method of Testing Current Transformers.—R. S. J. SPILSBURY.—The direct electrostatic system previously in use, according to the author, while capable of the necessary accuracy, demands great steadiness in two circuits and very careful observation, the deflections obtained being small. The time required is also considerable. The method outlined in this article is said to overcome these difficulties and has the advantage that it employs only apparatus already available. A wiring diagram and complete description of the method are given in the original.—London *Electrician*, March 11, 1921.

Telegraphy, Telephony and Signals

Guided-Wave Telephony.—CHARLES A. CULVER.—After dealing with the principal equipment required for systoms using wires already in place for radio telephony the author summarizes the uses and advantages of guided-wave telephony as follows: (1) It gives more nearly perfect reproduction of the voice than wire telephony. (2) It gives a higher degree of secrecy in communication. (3) Communication may be maintained between two points when the physical circuit is out of commission for ordinary telephone service. (4) The system possesses great flexibility. (5) An important possible application of telephony by guided waves is that of train dispatching. (6) An application of a similar nature to the one last mentioned would be the dispatching of electric railway traffic by this type of telephony. In conclusion the author asserts his belief that in guided-wave multiplex telephony and telegraphy a distinct branch of communication engineering has been developed which should command close study.—*Journal Franklin Institute*, March, 1921.

Submarine Cables.—F. A. WESTBROOK.—An article dealing with the manufacture of submarine cables for communication purposes, giving the construction of such cables and the tests which should be made on the cable during and at completion of the manufacturing process.—*N. E. L. A. B.*, February, 1921.

Miscellaneous

Stress Determination by Means of the Coker Photo-Elastic Method.—A. L. KIMBALL, JR.—The optical system of the apparatus used for determining stress by polarized light is analyzed in this article, and an explanation is given of the operation of a polarizing prism and of the quarter-wave plate. The nature of stress and how it influences polarized light is briefly considered with an explanation of the color effects produced. A proof of the quantitative law of variation of light intensity with stress for one color is given for the standard set-up of the apparatus. The method has important applications in investigation of stresses in electrical machinery.—*General Electric Review*, January, 1921.

Flow of Water in Concrete Pipe Lines.—An extensive series of tests provides data showing the effect of variations in the character and condition of concrete pipe on the coefficients of retardation for use in various formulas.—*Canadian Engineer*, Jan. 6, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Bill Providing Commission Regulation for Delaware Defeated

BY A vote of 18 to 14 the Assembly branch of the Delaware Legislature has defeated a bill providing for the creation of a state board of public utility commissioners. The bill as presented provided for the appointment of four commissioners by the Governor, each to receive compensation at the rate of $3,000 a year, and appropriated $30,000 for operating expenses. Delaware is one of the eight states having no form of state regulation over electric public service corporations.

Manufacturers' Council to Take Up Freight Classification

THE Electrical Manufacturers' Council announces the creation of a transportation committee to take up matters of railroad freight classification. The committee is composed of W. B. Everest, chairman; M. C. Fitz-Gerald, A. T. Zwaek and F. C. Bryan.

Shiras Morris, president of the Hart & Hegeman Manufacturing Company, Hartford, Conn., and the recently elected president of the Associated Manufacturers of Electrical Supplies, has been elected treasurer to fill the unexpired term of the late Edward B. Hatch.

Resolutions of sympathy on the death of Mr. Hatch have been passed by the council. Mr. Hatch, who died on Feb. 18, had been a member of the council since its organization on Feb. 7, 1916, and its treasurer from Nov. 7, 1919.

Weeks Would Complete Muscle Shoals Project

IF SOME commercial organization will show faith enough in Muscle Shoals to agree to take over the project after it shall have been completed the Secretary of War will ask Congress to furnish the $30,000,000 necessary to finish the Wilson Dam. A reply to the foregoing effect was made by Secretary Weeks when the correspondent of the ELECTRICAL WORLD asked him if he had any personal opinion as to what should be done in the matter. Secretary Weeks stated that he had formulated no policy with regard to Muscle Shoals, but "if it is a good thing some one should be willing to demonstrate their faith in the proposition by agreeing to take it over when completed."

The work on the Wilson Dam is being slowed down rapidly and the project put in such shape as to deteriorate as little as possible during the period that no funds for continuing the work will be available. There is a very generally held opinion that some plan will be devised which will permit the completion of the dam. None of the contracts for electrical machinery has been canceled.

Secretary Weeks has suggested that it may be well to have the Federal Power Commission investigate the possibilities of marketing power in the vicinity of Muscle Shoals.

Friendly Solution Pledged of Inductive Interference Problems

A BROAD spirit of co-operation can easily overcome present legal and engineering inductive-interference problems, according to the unanimous opinion of those present at the first meeting of a joint committee of representatives of the American Telephone & Telegraph Company and of the National Electric Light Association at the office of O. D. Young, vice-president of the General Electric Company, March 26.

This meeting was called by agreement between the public policy committee of the N. E. L. A. and the executives of the telephone company for the formulation of a national policy on all inductive-interference matters between the Bell telephone companies and N. E. L. A. member companies, in the expectation of eliminating inductive-interference controversies and litigation. The two utilities agreed that every effort shall be made to arrive at a friendly solution of all present existing differences.

A careful study of all existing statutes, commission rules and regulations and court decisions which govern the question of inductive interference in the different states is to be made by Charles Neave of New York City, who was engaged for that purpose. A sub-committee is composed of Bancroft Gherardi, vice-president of the American Telephone & Telegraph Company; R. F. Pack of Minneapolis, as representing the N. E. L. A., and four engineer members, two from the N. E. L. A. inductive-interference committee, to be associated with Mr. Pack, and two from the engineering organization of the American Telephone & Telegraph Company, to be associated with Mr. Gherardi. This committee will report on the general engineering phase of the problem as a basis for formulating general rules of procedure.

The members of the joint committee are O. D. Young, vice-president General Electric Company, New York City; E. K. Hall, vice-president American Telephone & Telegraph Company, New York City; R. H. Ballard, vice-president and general manager Southern California Edison Company, Los Angeles; Martin J. Insull, vice-president Middle West Utilities Company, Chicago; Ber Read, president Mountain State Telephone & Telegraph Company, Denver; W. W. Freeman, president Union Gas & Electric Company, Cincinnati; Bancroft Gherardi, vice-president American Telephone & Telegraph Company, New York City; H. W. Byllesby, president Byllesby Engineering & Management Corporation, Chicago, represented by R. F. Pack, vice-president and general manager Northern States Power Company, Minneapolis; Col. John J. Carty, vice-president American Telephone & Telegraph Company, New York City; Guy E. Tripp, chairman of the board, Westinghouse Electric

& Manufacturing Company, New York City. Those present at the Saturday meeting were O. D. Young, chairman; Col. John J. Carty, R. H. Ballard, E. K. Hall, R. F. Pack, Bancroft Gherardi and M. H. Aylesworth., executive manager N. E. L. A.

N. E. L. A. Convention Arrangements Nearing Completion

WITH still two months to go, arrangements are fast being completed for the National Electric Light Association convention, to be held this year at the Drake Hotel in Chicago, May 31 to June 3. E. W. Lloyd, Commonwealth Edison Company and past-president of the association, has been appointed chairman of the committee on arrangements, and the following have accepted appointment: G. H. Atkin, W. H. Coleman, C. E. Allen, E. H. Cheney, G. A. Hughes, H. E. Niesz, F. R. Jenkins, E. A. Edkins, G. A. Freeman, O. R. Hogue, D. H. Howard, G. B. Foster, W. S. Kline, W. W. Low, J. G. Learned, H. V. Prather, E. J. Doyle, W. L. Abbott, W. H. Hodge, G. E. Cullinan, G. H. Jones and W. H. Ott.

Chairman Lloyd has announced the appointment of F. R. Jenkins, Commonwealth Edison Company, as chairman of the hotel committee; G. H. Atkin, Electric Storage Battery Company, as chairman of the transportation committee; O. R. Hogue, Commonwealth Edison Company, as chairman of the registration committee, and H. E. Niesz, Commonwealth Edison Company, as chairman of the entertainment committee.

Federal Water-Power Regulations Reopened

THE water-power committee of the National Electric Light Association and others appearing before the new Federal Power Commission in Washington, D. C., on March 25 submitted a number of suggested changes to the rules and regulations promulgated by the previous commission on March 4. Some of these rules, it was claimed, are of a nature to discourage if not altogether retard development because of inability to finance properly under them. In the group shown on the steps of the State, War and Navy Building in Washington, reading left to right, are: Front row—Thomas W. Martin, president Alabama Power Company, Birmingham; Henry J. Pierce, Washington Irrigation & Development Company, Seattle; O. C. Merrill, secretary Federal Power Commission; Franklin T. Griffith, president Portland (Ore.) Railway, Light & Power Company and chairman of the N. E. L. A. water-power committee; W. A. Brackenridge, vice-president Southern California Edison Company, Los Angeles; Guy W. Talbot, president Pacific Power & Light Company, Portland, Ore. Second row—O. G. Thurlow, chief engineer Alabama Power Company, Birmingham; R. H. Ballard, vice-president and general manager Southern California Edison Company, Los Angeles; Harrison B. Freeman, Connecticut River Company, Hartford, Conn.; W. H. Onken, Jr., editor of the ELECTRICAL WORLD; Hugh L. Cooper, consulting engineer, New York City; Paul Wooton, Washington, D. C. Third row—Dr. George L. Hoxie, consulting engineer, Los Angeles; C. M. Clark, president Tennessee Railway, Light & Power Company, Chattanooga, Tenn., and member of the firm of E. W. Clark & Company, bankers, Philadelphia; Senator J. Newcomb New York; Fred W. Herbert, N. E. L. A., and W. V. King, chief accountant Federal Power Commission.

Demand-Charge Rate Form Favored at Wisconsin Electrical Meeting

THE demand or service charge as a legitimate part of any rate structure was advocated by L. B. Andrus, American Public Utilities Company, in a paper on "Customer's Demand as a Factor in Rate Making," presented before the convention of the Wisconsin Electrical Association at Milwaukee on Thursday of last week. The total energy consumed, the maximum rate of consumption and the time at which the maximum occurs must be known of every service, as well as the costs dependent on the number of consumers, the costs involved in the cost of equipment to serve consumers and the costs depending on the kilowatt-hours produced. Equipment costs are independent of the two other costs, and Mr. Andrus pointed out the unfairness of a rate that buries this cost in a kilowatt-hour charge. Unless these charges are contained in a service charge it is possible to make consumers who are not properly chargeable with the demand costs bear the burden of other consumers. This may occur particularly when industries shut down.

The shortage of real salesmen and the presence in the merchandising field of men who were not real salesmen was dwelt upon by C. E. Michel of St. Louis in a talk on electrical merchandising.

F. A. Coffin of Milwaukee discussed the power-factor problem and methods of correction, and the use of induction-voltage regulators was discussed by Frank Hershey.

The independent telephone association of the state asked the appointment of a joint committee on inductive interference, the request being referred to the incoming executive committee for action.

Officers for the coming year were elected as follows: President, J. B. Pulliam; first vice-president, Harold L. Geisse; second vice-president, P. D. Kline; third vice-president, H. R. Ellis; secretary and treasurer, W. M. Chester.

Marine Committee of A. I. E. E. Issues Revised Recommendations

RECOMMENDATIONS of practice for electrical installations on shipboard issued by the marine committee of the American Institute of Electrical Engineers a few years ago and adopted by the committee of the American Bureau of Shipping did not cover the entire field and the committee was therefore continued, with instructions to prepare a more nearly complete set of rules. This has now been accomplished and the revised edition of the rules is ready. They are in part the result of a careful comparison made by the committee of similar rules prepared by American, English and German bodies.

No definite arrangements have yet been made for the approval of apparatus and accessories, but it is expected that through the co-operation of the Underwriters' Laboratories arrangements will be made later by which apparatus or appliances used on shipboard may be inspected and approved. In the absence of approved standards for merchant ships appliances approved by the Navy Department will in general be satisfactory.

American Telephone & Telegraph Stock Goes on 9 per Cent Dividend Basis

ANNOUNCEMENT by the directors of the American Telephone & Telegraph Company this week that they had established 9 per cent as the regular annual rate of dividend to be paid upon the company's shares indicates a recognition by this company of the necessity of offering a high rate of interest to attract new capital in the present money market.

"The change in dividend rate is nothing more than an adjustment to a new set of conditions," said H. B. Thayer, president of the company. "It has always been the policy of the company to pay such a dividend as would maintain the market value of the stock at a premium sufficient to attract subscription to new stock issues. The issue of a fair proportion of new capital rather than an increase of debt to take care of growth is a necessary part of any sound financial program.

"Not only present financial conditions governing the status of this and other investment securities have been considered, but also probable conditions in the future, and the action of the directors is based on the conclusion that a higher rate of return is necessary to attract capital from shareholders."

March Financing Shows Higher Yields

MARCH electric light and power company financing totaled $24,399,090, thereby exceeding February by almost $6,000,000. The tendency toward long-term securities is still evident. There is no appreciable change over last month in the interest rates, but the yields appear to be slightly higher. Of the thirteen issues the largest and most interesting is the $7,000,000 in bonds offered by the San Joaquin Light & Power Corporation of California. Of this issue $5,000,000 in thirty-year bonds is offered at 97.50, to yield 7.20 per cent, and $2,000,000 in one- to five-year serials is offered at from 99.06 to 97.95, to yield from 8 to 7.5 per cent.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
San Joaquin Light & Power Corp.	$5,000,000	30-year	Unifying and refunding mortgage bonds	Refunding and new construction	7	7.20	97.50
San Joaquin Light & Power Corp.	2,000,000	1-5 year (Serially)	Unifying and refunding mortgage bonds	Refunding	7	8-7.5	99.06-97.95
Abitibi Power & Paper Co., Ltd., (Canada)	4,000,000	10-year	Consol. mtge. sinking fund gold bonds	Refunding	8	8	Par
Great Western Power Co. of California	2,500,000	15-year	Gen. lien convertible gold bonds	New construction	8	8	Par
California-Oregon Power Co.	2,000,000	20-year	First and refunding mtge. sinking fund gold bonds, series A	Refunding	7.5	7.5	Par
Denver Gas & Electric Light Co.	1,000,000	25-year	Gen. mtge. gold bonds, series A	Refunding	7.5	7.85	96
Charlestown (Mass.) Gas & Electric Co.	200,000	10-year	Gold notes	.....	7	6.85	101
Los Angeles Gas & Electric Corp.	2,500,000	5-year	General and refunding mortgage gold bonds, series A	Refunding	7	7.40	98.25
Albany Municipal Gas Co.	1,250,000	1-year	Gold notes	Refunding	8	8	Par
Public Service Co. of Northern Illinois	2,000,000	15-year	Convertible gold debentures	.....	7.5	8.10	95
Merchants' Heat & Light Co. (Indianapolis)	700,000	15-year	Gold bonds	Refunding	7.5	8	95.67
Edison Electric Illg. Co. of Brockton	594,090	.....	Stock	Floating debt	...	.....	115
Ohio & Western Utilities and Ohio Utilities Co.	655,000	2-11 year	Joint serial gold notes	Refunding	8	9.10-8.25	98
Total	$24,399,090						

Kansas Electric Show Attracts Much Attention in Southwest

ELECTRICAL interests of the Southwest are concentrating their attention on the week of April 18, when the big electrical show will be held in Kansas City, Mo. Both the Missouri and the Kansas state utilities associations will convene at Kansas City during show week as well as the Missouri Association of Electrical Contractors and Dealers and the Western Electrotherapeutic Association. This is the first exhibition of its kind to be held in Kansas City, and already it has a list of eighty-five exhibitors. A number of interesting diversions are planned.

The committee which has worked out the details consists of F. M. Bernardin, H. C. Blackwell, W. B. De Forest, F. S. Dewey, A. P. Denton, C. F. Farley, Sam Furst (who is the manager of the show), W. M. Hand, J. E. Launder, P. L. Lewis, F. F. Rossman, W. B. Satterlee, A. J. Selzer and J. D. Todd.

Construction Begun on Ford's Hydro-Electric Plant at Troy, N. Y.

STONE & WEBSTER, INC., Boston, Mass., have received the contract to design and construct an 8,000-hp. hydro-electric plant at Troy, N. Y., for Henry Ford, and construction work began March 21. The station is understood to be the first to be started under license of the Federal Water Power Commission, and it is to be completed for power generation by June 1, 1922. The plant will utilize the waters of the Hudson River and will be situated on Green Island, near the heart of the city of Troy. The head to be developed will be about 13 ft. At this writing it has not been decided whether six or eight units will be installed, but the generating sets are to be of the vertical type, and the estimated cost of the plant is between $1,750,000 and $2,000,000.

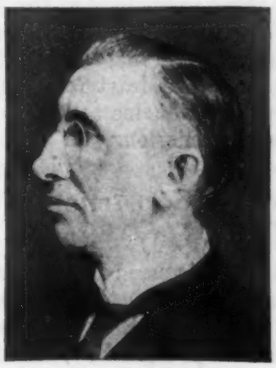
Chicago Electrical Men Oppose Regulation of Sale of Electrical Goods

A NEW ordinance regulating the sale, installation and use of electrical devices created a flurry in Chicago in the early part of this week. The ordinance was submitted to the Council on Monday and referred to a committee for consideration. It calls for a $50 license fee for all dealers in electrical devices, and no device that is not approved by the Commissioner of Gas and Electricity can be sold in the city. The routine for approval requires a preliminary fee of $5 to be paid with each application, and the city will submit each device to such examination and test as may be deemed necessary for its approval. The cost of such examination and test will be assessed against the applicant on the basis of time and expense involved. Provision for the acceptance of such approval as that of the Underwriters' Laboratories is made. The ordinance as originally submitted was so loosely drawn that gross misuse of the inspection fee provisions would be possible, and there was no differentiation between manufacturers going to the trouble and expense of obtaining the Underwriters' approval and those not doing so.

A strong protest against the ordinance as drawn has been made through the electrical section of the Association of Commerce. Among other things charges have been made from various sources that the ordinance is sponsored by union labor interests and that it is an attempt to provide another source of revenue for the city of Chicago. It is stated by the sponsors that the ordinance is an attempt to prevent the sale of unsafe devices in the city, and it is understood that insurance interests are backing the ordinance as a measure which they hold will aid the elimination of fire and other hazards due to the use of cheap and carelessly built devices. A strong fight against the ordinance in its present form will undoubtedly be made. It is stated that the ordinance will not come up fo. passage for some months and will not be effective before Jan. 1, 1922. It is understood that the committee in charge will hold public hearings on the subject.

Formation of Frazil Ice Easily Prevented

BETWEEN the continuous operation of a hydro-electric plant and its shutdown because of frazil-ice formation there lies only one-thousandth of a degree of heat. Thus did John Murphy, electrical engineer of the Canadian Department of Railways and Canals, voice to a representative of the ELECTRICAL WORLD his opinion of the ease with which ice can be combated. Mr. Murphy has been studying ice formation and successfully fighting it at power plants for nearly twenty years. A few years ago he astounded the engineering world with his motion-picture study of ice formation. "Others," said Mr. Murphy, "have been deterred from trying to combat ice because they could not be persuaded that it did not require large amounts of heat energy. They were positive that the temperature of all the water had to be raised. Now, as a matter of fact, the problem has but two phases—(1) preventing ice from adhering to things, and (2) preventing ice from forming in a stream. No water warming or ice melting is involved in either.



JOHN MURPHY

"Preventing ice from adhering to dams, valves, gates, racks and turbine cases is now becoming quite common—not by employing large quantities of heat, but by merely raising the temperature of the exposed surfaces the slightest fraction of a degree above the freezing point. Ice simply won't form on objects that are above the freezing temperature.

"On the other hand, the ease with which the formation of ice may be prevented is not yet widely understood, although 'nature' is doing that very thing every winter at 'air holes' by simply turning up new water which has not given up its latent heat. Thus the small quantity of heat needed to prevent ice from forming at a given point in any river is quite comparable with the small quantity of moisture which if applied to inflammable material will prevent the starting of what might be a serious fire.

"Toward the end of many winters a block of ice con-

taining 6,000 cu.ft. can be cut from a one-foot length of the St. Lawrence River at points where it is 3,000 ft. wide, when the ice is two feet thick. However, it has taken the whole winter's frosts to make that much ice at that point. The average flow of the St. Lawrence is 240,000 cu.ft. per second. Therefore in one-fortieth of a second—the flick of an eyelid—as much water passed the point in question as was turned into ice in four months. It must be realized, therefore, that it is not necessary to do something to all the water in order to prevent ice from forming in a small part of it."

Utilities Oppose Proposed Administrative Code for Ohio

PUBLIC utilities in Ohio are opposed to some of the provisions of House bill No. 249, commonly known as the "administrative reorganization code bill," recently introduced in the Ohio Legislature. These objectionable provisions are in the section which places public utility companies under the control of a proposed director of commerce, giving to him power of appointment and removal of the Public Utilities Commission's staff of assistants, such as inspectors, engineers, accountants, statisticians and clerks. The bill also makes this official the secretary of the commission.

The utilities are opposing these provisions of the bill on the ground that the work of the commission would be seriously retarded thereby, and that inasmuch as the director of commerce would control at least four other departments he would have very little time to devote to his duties as secretary of the commission.

Honest, Dispassionate, Constructive Thinking Needed, Mr. Hayes Says

A DECLARATION that the basic need of the hour is honest, dispassionate and constructive thinking was made by Paul F. Haynes of the Indiana Public Service Commission in talking of the utility problems at the annual banquet of the Oklahoma Utilities Association at Oklahoma City on March 9. The present difficulties are partly the fruit of the old-time "public-be-damned" policies that are now dead, and the demagogues and the politicians form two groups that still present an effective barrier against the solution of utility problems that the public honestly desires. Mr. Haynes said that it was his belief that the utilities were largely responsible for the barrier, because they had not recognized that adequate service was an obligation concurrent with the public obligation to pay.

In defining adequate service Mr. Haynes pointed to proper public relations as the first essential and indicated this essential as the one in which the utilities had failed, even though in the narrower sense they had furnished service that was adequate from an electrical standpoint. Too much of the utilities' public relations work has been carried out in a spirit of anticipated opposition. This attitude only stirs up the opposition it assumes to exist. Another fault pointed out by Mr. Haynes was the failure in approaching the public to use language that the ordinary individual understands. If the people are to grasp utility problems, the explanations must be devoid of the technical language of the industry.

It is the duty of the public to maintain not only solvency but utility health as well, and Mr. Haynes expressed the belief that utility regard for utility obligations to the public should be liberally rewarded and lack of such regard should result in restriction of earnings. In conclusion, Mr. Haynes dwelt on the danger lying in the control of the commissions by the public when that public had not been taught the true situation through proper development of public relations by the utilities.

At the sessions on March 10 C. L. Mitchell of Cushing discussed the problems of the small-town utility, pointing out strongly the part that the minor employees play in the relations of the smaller utility with its public. That the quality of service depends on the handling of complaints was Mr. Mitchell's belief, and therefore troublemen and others who handle complaints must not be mediocre types of men. Complaints were viewed as a safety valve. They should be encouraged and not suppressed. Few business ventures give the opportunity to display courtesy that is afforded by the public utility business. Mr. Mitchell defined a utility man's place in the community as depending on his ability to think individually, act collectively and keep out of politics.

Steel Electrical Engineers' Convention to Be in Chicago in September

SPECIAL emphasis will be given to steel-mill problems and steel-making practices at the fifteenth annual convention of the Association of Iron and Steel Electrical Engineers, which will be held in September at the Hotel La Salle, Chicago.

Papers will be presented by R. B. Gerhardt, electrical superintendent Bethlehem Steel Company, Sparrows Point, Md.; R. D. Cousins, electrical engineer Illinois Steel Company, Gary, Ind.; Wray Dudley, electrical superintendent Ashland Iron & Mining Company, Ashland, Ky.; W. N. Flanagan, steam engineer Ohio Works, Carnegie Steel Company, Youngstown, Ohio; F. B. Crosby, electrical engineer Morgan Construction Company, Worcester, Mass.; A. C. Bunker, electrical engineer Crocker-Wheeler Company, Ampere, N. J.; A. M. MacCutcheon, designing engineer Reliance Electric & Engineering Company, Cleveland, and E. T. Moore, electrical engineer Holcomb Steel Company, Syracuse, N. Y. Other papers will be presented on the following subjects: Education standardization, safety and electrical development in steel mills, by the chairman of the respective committees. In connection with the convention there will also be the regular exhibition of electrical products.

Dallas Electric Club Working to Build the Southwest

PLANS are being worked out by the Dallas Electric Club to build up the Southwest electrically, and to this end it will appoint a committee made up of representatives of the several branches of the industry. This activity has come as the result of recommendations by the retiring president, A. Hardgrave, manager of the Insull properties in Texas. Among his recommendations are a permanent electric exhibit building at the state fair grounds, an annual electric parade during the state fair, a movement in conjunction with the Chamber of Commerce to make Dallas the electrical jobbing and distributing center for the Southwest and a renewal of the efforts to build up the work of "co-operation within the industry."

Analysis of Power Situation During the War

ALMOST instructive and interesting report on the power situation in the various industrial sections of the country during the late war has just been issued by the War Department. The main portion of the report is by Colonel Charles Keller, Corps of Engineers, as the officer in charge of the work of the War Industries Board and of the power section of that board. Summarized and detailed reports are given on the power shortages existing and the methods taken to relieve them in the following important industrial districts: Niagara Falls and Buffalo, Pittsburgh and eastern Ohio, the New England States, the State of New Jersey, Philadelphia and eastern Pennsylvania, Wilmington and Baltimore districts and the Pacific Coast.

The summary of the various investigations and reports made by the officers of the Power Section of the War Industries Board is written by Major (now Colonel) Charles F. Lacombe, who acted as Adjutant for the Power Section. The main portions of this summary as pertaining to the great industrial centers in New England and the Middle Atlantic States was published in the ELECTRICAL WORLD of May 15, 1920, under the title "Urgent Need of Super-Power Developments." This summary report contains many very valuable transmission-line maps and diagrams, most interesting of which perhaps are several production charts of various industries showing the cumulative effect of shortage of power, labor and transportation facilities.

SECTIONAL REPORTS

The power situation in western Pennsylvania and eastern Ohio is ably covered in a report on that section by Capt. Lyle A. Whitsit. An extract from this report was published in the ELECTRICAL WORLD on Nov. 13, 1920, under the title "Power Service for a Middle West Section." Valuable maps, diagrams and tables accompany the report.

Major Carroll H. Shaw's report on the "Production, Transmission and Distribution of Mechanical and Electrical Power in New England" is most comprehensive and gives in detail the status of the power industry in each of the New England States. The main portions of this report were published in the ELECTRICAL WORLD on Sept. 11, 1920, under the title "Survey of New England Power Situation."

Electrical power in New Jersey and eastern Pennsylvania is covered in a report by Major Malcolm MacLaren. The future power demand of this district is thoroughly analyzed, and the costs of various hydroelectric developments necessary to provide the energy are given.

A review of the electric power resources of the Southern States at the close of the war, with recommendations for efficient development to accommodate estimated demands for the future, is contained in a report by Capts. George K. Miltenberg, Lyle A. Whitsit and Robert W. Lamar. An extract from this report was published in the ELECTRICAL WORLD of Oct. 16, 1920. One of the most valuable parts of this report is the appendix, in which data are given on the load factors of various Southern systems, as well as cost data on steam generated power.

The final report is by Major George F. Sever on the "Electric Power Problems on the Pacific Coast." Major Sever takes up in detail the present and probable future power demands of these states and makes definite recommendations. A detailed list of the various interconnections in this section forms one of the most valuable portions of this report.

Meter Lecture and Slide to Be Made Available for Meter Departments

THIS year's convention report of the meter committee, Technical Section, N. E. L. A., will include as an appendix a lecture on meters which has been in the course of preparation for a long time. After the report has been published copies of the lecture will be printed separately. Together with about thirty lantern slides, they will be available for use by meter departments throughout the country. The lecture will be used extensively in the educational work which the meter committee is doing, including the university courses for metermen and similar activities.

The scope of the lecture is very broad. It covers the historical development, units of measurement, operating principles, construction essentials, testing and commission regulations.

Peace-Time Industrial Co-operation Under Government Supervision Urged

ENCOURAGEMENT of permanent intimate combinations or associations of industry under government supervision, involving a radical change in the present attitude of the government toward such groupings, is recommended in the final report of the United States War Industries Board, just completed by Bernard M. Baruch, who was the board's chairman. It is held that great public benefits in the way of prices and abundance of goods, resulting from economies in production and distribution, are capable of being effected through the mutual co-operation of members of industrial groups and that the present governmental policy of enforced isolation and costly competition is not conducive to the general welfare.

The first part of the book traces the origin of the War Industries Board in the Council of National Defense, defines its purposes and treats of the process by which the board became the one governmental body that dealt comprehensively with the exceptional military and civil industrial requirements caused by the war and the resources and facilities with which to meet them, and how the balance between them, on the success of which hinged industrial mobilization and the outcome of the war itself, was sought and attained through the administration of clearance, priorities, conservation, price-fixing, labor administration and the work of the board's foreign mission.

As a result of the successful uniting of government and business under the War Industries Board for national purposes the report advises that there should be established some sort of government tribunal which should sanction in the public interest the intimate associations of industries which resulted in such economies and enlargement of production during the war. The report, therefore, recommends that purely as a civic measure legislation be adopted that will permit the continued functioning of the industrial groups represented by the war service committees and the related associations of manufacturers, whose establishment was forced by the war exigency.

Telluride Power Wants More Time to Complete Beaver River Project

BECAUSE of the difficulties in obtaining labor and material during the war the Telluride Power Company was unable to complete its power project in Beaver River Canyon within the time limit and has petitioned the United States District Court for relief. The court is asked to set aside the ruling of State Engineer George F. McGonagle allowing only a one-year extension and to grant two years instead.

A permit for diverting the waters of the canyon was granted in 1917, with a time limit to Dec. 31, 1920. Already more than $100,000 has been spent on the project in roadways, bridges and the laying of 12,700 ft. of 36-in. wood-pipe line. This will be a loss if sufficient time is not granted to complete the original scheme, according to the bill of complaint which has been filed.

Engineers of Utah Organize State Council

AN ENGINEERING council for Utah, including representatives from all branches of the engineering profession—civil, mining, electrical and mechanical—has just been organized with headquarters at Salt Lake City. The purposes of the organization are united consideration of and action on matters of common concern to engineers, as well as matters of public welfare embodying the application of engineering principles; the advancement of engineering knowledge and practice, the maintenance of a high professional standard among engineers and the correlation of the local activities of engineering societies.

The Engineering Council of Utah will be directed by a governing board consisting of two representatives from each of the member societies. The governing board, as represented at the first meeting of the Engineering Council, included the following men: American Society of Civil Engineers—R. K. Brown and Theodore A. Beyer; American Institute of Electrical Engineers—Dr. Joseph F. Merrill, Paul P. Ashworth; Utah Society of Engineers—Hylom T. Plumb, A. C. Watts; American Institute of Mining Engineers—Henry M. Adkinson, Edward R. Zalinski; American Association of Engineers—Charles J. Ullrich, Charles S. Fisher; American Society of Mechanical Engineers—Louis J. Seckles, L. Douglas Anderson.

Temporary organization was effected by the election of Hylom T. Plumb as chairman and Theodore A. Beyer as secretary. Plans were laid for a general ratification meeting to be held in the form of a banquet for all engineers of the state at an early date.

Must Guard Against Effects of Prosperity

A NOTE of caution to utility executives was sounded by Adam Gschwindt, president of the Illinois State Electric Association, at the banquet which closed the annual convention at Chicago, March 15 and 16. Mr. Gschwindt said that prosperity often had a deteriorating effect on the personnel of a utility and that this should be most carefully guarded against now that the utilities were over the hill of high costs and could see an easier road ahead.

Other speakers were Congressman Ira C. Copley, President David Kinley of the University of Illinois, and Charles A Munroe, president of the American Gas Association, who advised that all gas and electric companies endeavor to show regulatory bodies the necessity of "service" charges.

Electrochemists to Meet at Atlantic City April 21-23

A LARGE attendance is looked for at the forthcoming convention of the American Electrochemical Society at the Hotel Chalfonte, Atlantic City, April 21-23. At this time the action of the board of directors authorizing the formation of an electrothermic division will be put before the membership for confirmation. This new division will absorb the Electric Furnace Association. Acheson Smith, president of the Electric Furnace Association, has been named to organize the new division.

The convention program includes a symposium on corrosion, to be held on the morning of the twenty-first, running over into the next morning. This is followed by five electrical papers: "Phenomena of Arc Welding," by O. H. Eschholz; "Electric Furnaces for Non-Ferrous Metals," by H. W. Gillett; "Electrodynamic Forces in Electric Furnaces," by Carl Hering; "Recent Progress in High-Frequency Induction Heating," by E. F. Northrup, and "The Regulation of Electric Steel Arc Furnaces Using Movable Electrodes," by W. G. Mylius.

The closing session on Saturday morning will be devoted largely to electrolytic papers and will include a paper by C. W. Hazelett entitled "A new High-Capacity Storage Battery."

The Engineering Council Gives an Account of Its Stewardship

FROM June, 1917, to December, 1920, the Engineering Council, a department of the United Engineering Society, functioned, chiefly at Washington. On the latter date its duties were taken over by the American Engineering Council of the Federated American Engineering Societies. A brief history of some of the Engineering Council's activities has now been issued in pamphlet form by J. Parke Channing, who succeeded Ira N. Hollis as chairman in February, 1918; Philip N. Moore and Alfred D. Flinn. The United Engineering Society had as its constituent members the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society for Testing Materials and the American Railway Engineering Association. This "final report and brief listing" of what it accomplished during the war and in the reconstruction period deals with its origin and powers, its membership and meetings, its financial resources, its offices, officers and committees, its publications and publicity, its "American Engineering Service" and employment bureau, and the "contacts" established by it among engineering societies and the technical professions. As the forerunner of the American Engineering Council it demonstrated, in the words of the pamphlet, "the feasibility of a joint representative organization of technical societies to deal with questions of general interest to engineers and to the public and made definite progress in determining the extent of the field which such an organization could wisely cultivate."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

A Canadian Railroad Electrification Project Postponed. — The Canadian Minister of Railroads has announced that there is no possibility of the Dominion government's giving any consideration to the electrification of the London, Huron & Bruce branch of the Grand Trunk Railway until the whole Grand Trunk system, which is the subject of arbitration proceedings, becomes definitely the property of the government.

Great Artificial Lake Advocated for Asheville District.—Very large hydroelectric possibilities are held to inhere in a plan advocated by Dr. Joseph Hyde Pratt, State Geologist of North Carolina, for the creation of an artificial lake on the upper French Broad River, extending from a point south of Asheville to one near Brevard. Such a lake would be about 30 miles long and cover an area of more than 20,000 acres and would add to the beauty of the Blue Ridge Mountains. It is hoped to form an association to carry out the project.

San Joaquin Light & Power Asks for Complete Revaluation.—Application has been filed with the California Railroad Commission by the San Joaquin Light & Power Company asking for a complete revaluation of its properties in order that a just rate base may be established. The company asserts that the last valuation, made as of Jan. 1, 1916, no longer represents the fair value of its properties, and that the great demands upon it resulting from the remarkable growth and development in the San Joaquin Valley necessitate a new rate schedule.

Engineers on the Severn Barrage.—Under this title the London *Engineer* summarizes some views expressed by delegates at a joint meeting of civil, mechanical and electrical engineers held in Birmingham, England. One delegate said that the cost of machinery with a rating of 476,000 kw. would work out at something more than £17,000,000 and that if the Thury system were employed this could be reduced to £11,000,000. Another estimated the cost of machinery, switchgear and transmission lines at £20,000,000. For financial and other reasons the meeting showed itself opposed to the scheme in anything like its entirety, though one engineer thought that with its aid it would be possible to transmit a maximum load of 100,000 kw. from the Severn to the Birmingham district by overhead lines at a capital cost of £1,000,000, which would make it possible to supply Birmingham with energy at 0.8d. (1.6 cents) per kilowatt-hour. The whole project was thought worthy of further inquiry, although the "brass band" advertising by the government was held to have retarded any possible realization of its practicable features.

Emergency Service in Cork.—Owing to a strike in the troubled city of Cork, in Ireland, a sudden stoppage of electric supply recently took place. How this handicap was overcome in one factory by the use of tractors is thus related: Energy for small machines and for lighting was supplied by a group of twelve tractors driving a length of line shafting from which in turn dynamos were driven. Six 20-hp. and four 25-hp. electric motors were driven as dynamos, while one tractor drove a 20-hp. motor to supply the shunt-field current required by the others. The system of the shop was 460-volt, three-wire, direct-current, and a balancer had to be provided. This consisted of two 20-hp. motors directly coupled. The installation gave an average output of 200 hp. and is said to have worked admirably.

Transcontinental Radio Signals Reach Moving Automobile.—Signals sent out by Atlantic Coast radio stations were received recently by apparatus carried in an automobile moving along the streets of San Francisco. This is said to be the first time that such long-range signals have been received by light portable equipment of this sort. The antennas consisted of a stranded copper wire aërial hung about 10 ft. above the ground by means of bamboo poles at the front and rear of the automobile. Nothing but the frame of the machine was used for a "ground." The signals were clearly audible without the use of amplification, only one bulb being used. Except for a 6-volt storage battery the receiving set was entirely contained within a small cabinet of about the same size as an ordinary suitcase. The set was not specially made up for this purpose but is a standard product turned out by a San Francisco radio manufacturer. The first tests were made on top of Twin Peaks, an eminence in a part of the city where power lines and street cars would not interfere with the signals. The test was so successful there that the automobile was driven down into the city and the signals continued to be clearly audible even when the automobile was driven close to electric cars in operation. E. A. Portal conducted the demonstration.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

N. E. L. A., Southwestern Geographic Division.—The annual meeting of this division of the N. E. L. A. will be held in Hot Springs, Ark., on May 13-14.

Pennsylvania Electric Association.—The Western Geographic Section of this association (which is the state section of the N. E. L. A.) will meet at Pittsburgh on Friday, April 15.

Electrical Supply Jobbers' Association.—The thirteenth annual meeting of the Electrical Supply Jobbers' Association will be held at the Homestead, Hot Springs, Va., on May 25-27.

A. I. and S. E. E., Philadelphia Section.—The date of the meeting of this section announced for April 4 has been changed to April 2 (tonight). D. M. Petty, as already stated, is to speak on the topic "Generation of Power in Steel Mills."

Ontario Municipal Electric Association.—Officers of this association for the ensuing year have been elected as follows: President, Willoughby Ellis, Hamilton; first vice-president, J. E. Banwell, Windsor; second vice-president, Controller Maguire, Toronto; third vice-president, R. F. Elliott, Kingston; fourth vice-president, W. K. Sanderson, St. Thomas; secretary-treasurer, T. J. Hannigan, Guelph.

Chicago Section, A. I. and S. E. E.—The following nominations for officers for the coming year were made at a meeting of this section held on March 22: For chairman, J. L. Mills and Elbert Lewis; vice-chairman, C. W. Donovan; executive committeemen, G. E. Adams and H. E. Davis. A paper on "Control Equipment for Auxiliary Motors," read by J. D. Wright of the Schenectady plant of the General Electric Company, was followed by a general discussion of the subject of motor control. It was announced that the April meeting would be a joint one with the Chicago Section, A.I.E.E., and that the meeting for May would consist of an inspection trip through the Allis-Chalmers plant at Milwaukee.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Philadelphia Section, April 2; Cleveland Section, April 11; Pittsburgh Section, April 16.

A. I. E. E. Section Meetings—Pittsburgh (joint session with A. I. and S. E. E.; for program see issue of March 19, page 672), April 16; New York (joint session with A. S. M. E.), April 22; New York, May 20.

Missouri Association of Public Utilities — Kansas City, April 21-23.

American Electrochemical Society—Atlantic City, April 21-23.

American Physical Society — Washington, April 23.

United States Chamber of Commerce — Atlantic City, April 27-29.

American Society of Civil Engineers — Houston, Tex., April 27.

American Association of Engineers—Buffalo, May 9-11.

N. E. L. A., Southwestern Geographic Division—Hot Springs, Ark., May 13-14.

Southwestern Electrical and Gas Association—Galveston, Tex., May 18-21.

American Society of Mechanical Engineers —Chicago, May 23-26.

Electrical Supply Jobbers' Association—Hot Springs, Va., May 25-27.

N. E. L. A.—Annual convention, Chicago, May 31-June 3.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Prevention of Competition Is Meant to Serve Public, Not Utility.—In approving the entrance of a light and power company into territory previously served by another on condition that the new company agree to purchase such portion of the existing utility's property as may be useful to it the Public Service Commission of Missouri observed that the protection from competition of an established utility in occupied territory is incidental to the protection of the public interest and does not warrant the exclusion of a competing utility rendering more efficient service at cheaper rates than the existing company is willing or able to do.

Advance in Rate by Producing Company Does Not Warrant Corresponding Increase by Distributing Company.—In granting increased rates to the Pine Grove Electric Light, Heat & Power Company, found warranted by increased operating costs and additional investment in plant extension, the Public Service Commission of Pennsylvania declares that an advance in price for energy by a producing electric company is not in itself a sufficient reason or excuse for an increase in the tariff of a distributing company. Such a method of increasing rates by a distributing company is wrong in theory and practice, the commission held, and should not meet with approval in any instance unless supported by data showing that the utility initiating the increased rate was warranted as a proper operating economy in promulgating it.

Effect of Abrogation of Special Contracts in Utah.—In granting temporary permission, pending valuation, to the Utah Power & Light Company to revise its rates in the case of 2,000 power customers, thereby gaining about $200,000 additional annual revenue, the Public Utilities Commission of Utah said, referring to the recent decision of the State Supreme Court in the "special contract" cases: "If these special contracts had been continued in effect, it would have been necessary in order to provide the power company with revenues shown to be needed to enable it to continue giving adequate service to the public generally that power consumers not enjoying special contract service pay very much higher rates than are herein found to be reasonable, thus placing the total burden of the increase upon the customers already paying highest rates. The rates hereinbefore fixed for the various classes of power users are intended to be applied to all power users of the respective classes, including the special contract holders." The increased revenue in sight because of the commission decision referred to and the Supreme Court decision together represent less than half the amount asked for in the power company's petition for increased power rates, filed Dec. 4, 1919.

Relation of Depreciation Reserve to Valuation.—In fixing the value of the Wood River Power Company, the Public Utilities Commission of Idaho made no deduction for accrued depreciation, declaring: "Because it is not possible to meet the factor of depreciation from day to day or year to year, the full serviceability of the utility's property can be maintained only when there is a provision against the time when retirement or replacement must be made. From the nature of the obligation which rests upon the utility this provision is as much a part of the utility's property as any physical unit in it, and when present it makes the immediate physical condition of the property unimportant, as whatever may have gone from the physical property through use is represented in a ready financial ability to retire or replace."

Discrimination Not Necessarily Involved Where Rates of Supplying Company to Transmission Company Are Lower than to Others.—Rates of a supplying electric utility to a transmission utility lower than rates to other consumers within the same classification are not unlawfully discriminatory, the Missouri Public Service Commission held in granting financial relief to the St. Joseph Transmission Company, so long as the difference in charge does not result in a burden being placed on the consumers of the supplying utility or an undue burden upon the supplying utility itself, whereas rates of a transmission electric utility to a local distributing utility which result in the rendition of such service at an actual loss and so reflect upon operation as a whole as to occasion operation at a loss are clearly discriminatory and unlawful.

Tennessee Commission's Attitude on Valuation.—In valuing the property of a Tennessee gas company for the purpose of rate fixing the Tennessee Public Utilities Commission considered three estimates made by experts on the basis respectively of historical cost, cost to reproduce new less depreciation based upon average prices for 1915-1919, and cost to reproduce new less depreciation based upon present prices, and indicated its attitude toward these varying methods in the following terms: "The public should not be made to bear the burden of the abnormally inflated present-day prices of both labor and material, as a rate of return upon a value reached alone by such a method would be prohibitory. At the same time the company should not be made to bear the burden of too low a valuation based upon an estimate of its historical or original cost less depreciation, as a return upon a value reached alone by such a method might prove confiscatory."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Corporations Cannot "Pick and Choose" Their Customers.—"Corporations which devote their property to a public use may not pick and choose, serving only the portions of the territory covered by their franchises which it is presently profitable to serve and restricting the development of the remaining portions by leaving their inhabitants without the service which they alone render," the Supreme Court of Missouri has declared in upholding a ruling of the State Public Service Commission ordering the Ozark Power & Water Company to serve the city of Diamond with electrical energy at 15 cents a kilowatt-hour.

What Constitutes an Injury Arising Out of or in the Course of Employment.—It has been held by the Supreme Court of Iowa, in Young vs. Mississippi Power Company, that when the engineer of an electric pumping station attempted to repair a crossarm broken during the unloading of a transformer in which he was assisting and lost his life from contact with high-tension wires he was not a volunteer but was killed by an injury "arising out of or in the course of his employment" within the meaning of the workmen's compensation act, the peril threatening his employer's property being an emergency justifying his conduct. (180 N. W. 986.)*

Property of Utility Devoted to Public Use Cannot Be Condemned Under General Authority.—The Supreme Court of Vermont has, in Vermont Hydro-Electric Corporation vs. Dunn, denied the power of the Mayor and Aldermen of the city of Rutland to condemn water rights owned by the plaintiff for the purpose of increasing the city's water supply, declaring that to bring property within the immunity from condemnation under general legislative authority that inheres in property already appropriated to a public use it is not necessary that it shall have been acquired by eminent domain or that it be actually in use for the public purpose. It is exempt from condemnation for a different public use when it is in immediate and necessary connection with a public trust or when acquired by a public service corporation for a necessary purpose pertaining to its franchise and held in anticipation of future needs, with bona fide intention to use it for such purpose within reasonable time. (112 At. 223.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

S. M. Kennedy, vice-president of the Southern California Edison Company, Los Angeles, in charge of business development and public relations, recently delivered an address in Los Angeles before about 600 employees of the American Railway Express Company. Mr. Kennedy's invitation to address the express company came from J. F. Baker, general manager, who had been inspired by Mr. Kennedy's new book, "Winning the Public," and saw in its philosophy something of direct application to the company's policy of endeavoring to establish closer relations with the public. Mr. Kennedy has spent a great many years in the study of public relations, and the book referred to is an interesting key to the success which he has attained in bringing about a better understanding of the essential service rendered by a public utility.

S. M. KENNEDY

E. F. Pegg has opened a consulting engineering office in Cleveland for the purpose of handling contractors' equipment of all kinds. Mr. Pegg has been associated with various manufacturers for the past twelve years.

D. K. Lewis has been appointed electrical engineer of the Winnipeg (Man.) Electric Railway, succeeding L. Trott. Since December, 1918, Mr. Lewis has been electrical engineer of the Fort Dodge, Des Moines & Southern Railroad, Boone, Iowa. Mr. Lewis was graduated from Clemson College, S. C., in 1903 in electrical and mechanical engineering. He entered the testing department of the General Electric Company at Schenectady, N. Y., and was later transferred to the engineering office in Chicago, where for twelve years he was construction foreman, installing apparatus in various towns and cities in the Western States. He enlisted in the United States Army in April, 1917, and was discharged in December, 1918.

R. F. Gooding, formerly a member of the engineering department of the Westinghouse Electric & Manufacturing Company, and more recently engineer with Mees & Mees, consulting engineers at Charlotte, N. C., has recently become associated with Tucker & Laxton of Charlotte and is engaged on transmission-line work between the United States nitrate plants Nos. 1 and 2 in northern Alabama. His position with the company is superintendent of construction. A biographical note on Mr. Gooding appeared in the ELECTRICAL WORLD of May 29, 1920.

Fremont L. Lovett, who has been appointed general superintendent of the Montpelier (Vt.) & Barre Light & Power Company, was born at Warren, Vt., in 1890 and was graduated in 1913 from the electrical engineering course of Norwich University. He was employed for about a year each by the Vermont Marble Company, the State of Massachusetts and in New York school work. He then entered the employ of the Worcester (Mass.) Electric Light Company as inspector of underground installations, later being promoted to the post of distribution engineer, which he resigned to go to Montpelier in the capacity above named. The company is managed by Charles H. Tenney & Company of Boston.

F. L. LOVETT

Julius L. Hecht has been elected by the board of directors of the Public Service Company of Northern Illinois to the position of assistant to Vice-president Frank J. Baker. Mr. Hecht has been in the employ of the company since 1905. He became mechanical engineer in charge of the operation of stations in 1907 and later was made superintendent of the electrical production department. He has been chairman since its inception of the central committee on co-operation, maintained by the company to govern relations between its employees and itself. Mr. Hecht is a vice-president of the Western Society of Engineers, having been interested in the affairs of this society for a number of years. He is also president of the National District Heating Association and is a member of the American Society of Mechanical Engineers and various other technical organizations. He was graduated from the Massachusetts Institute of Technology in 1904. Mr. Hecht will assume the responsibilities of the position held by the late George H. Lukes, general superintendent.

J. L. HECHT

H. C. Hoagland, formerly vice-president and general manager of the Central Oklahoma Light & Power Company, a Byllesby utility, has resigned to become general manager of the Oklahoma Natural Gas Company. Mr. Hoagland has been a member of the Byllesby organization for about ten years, serving at different times as manager of the Muskogee Gas & Electric Company and the Fort Smith Light & Traction Company, in addition to filling the position he is now leaving.

J. D. Sullivan, who has become the chief electrician of the Ray (Ariz.) Consolidated Copper Company, was formerly superintendent of the Tucson (Ariz.) Gas & Electric Company, where he had supervision over the construction, operation and maintenance of the electric, gas and street-railway departments. After attending the University of Arizona Mr. Sullivan was employed for two years in the office of the Tucson city engineer, leaving that office to

enter the employ of the Tucson Gas & Electric Company. His term there was interrupted by three years' war service.

Charles A. Collier, who recently underwent an operation for appendicitis and was absent from his office for several weeks, has again taken up his duties as assistant to the general sales manager of the Georgia Railway & Power Company, Atlanta.

A. M. Little, whose resignation as president and director of the Mohawk Electrical Supply Company, Syracuse, N. Y., was mentioned in the March 15 issue of the ELECTRICAL WORLD, has become associated with the J. F. Buchanan Supply Company, Philadelphia, as manager. This company is affiliated with the J. F. Buchanan Company, composed of J. F. Buchanan and Gilbert S. Smith, which is one of the oldest electrical concerns in the country. Under the latter name the company operates a large electrical contracting business and has installed some of the most important electrical work in Philadelphia and surrounding country, particularly of the industrial type. Some years ago an electrical supply business, both wholesale and retail, was developed, and the J. F. Buchanan Supply Company was organized to handle this activity. Mr. Little brings to the Buchanan interests a wide experience. He has been actively engaged in the electrical supply business since 1889, when he was employed by the Central Electric Company of Chicago as an office boy. Later he was salesman in the East for the Pass & Seymour Company. As chief executive of the Mohawk Electrical Supply Company during the last twelve years, he has developed the business into one of the largest of the jobbing concerns in the country. The first dealers' conference, at which the jobbing firm called together all of its qualified dealers to discuss questions of mutual interest, was conceived and carried out by the Mohawk company under Mr. Little's initiative in May, 1919. This practice has since become general throughout the country. In many other ways Mr. Little has taken the lead in plans to encourage and develop dealers and in the wider use of electrical appliances and supplies. In national affairs he has been correspondingly active, particularly in the Electrical Supply Jobbers' Association. Of that organization he has been a member of the executive committee and was recently chairman of the Atlantic Division. He first advanced the idea of a campaign of publicity through the trade press and other mediums to bring before the entire industry the service the jobber is rendering, and as chairman of the publicity committee that was appointed to carry out the plan he has aided in putting the campaign into effect and carrying it on, to the resultant advantage of all electrical jobbers.

A. M. LITTLE

R. Lee Swittenberg, who has been appointed superintendent of plants and lines of the Anderson (S. C.) branch of the Southern Public Utilities Company, succeeds R. T. Long, who recently resigned. Mr. Swittenberg joined the company as a dynamo attendant at the Portman plant. About five years ago he was made superintendent of the Portman plant. Six months later he was made assistant superintendent of plants and lines under Mr. Long.

C. L. Drapher, formerly with the Kansas City office of the Elliott Company, Jeannette, Pa., manufacturer of power accessories, has been appointed district sales manager of the St. Louis office.

M. C. Sickels, of the Cleveland office of the Elliott Company, Jeannette, Pa., manufacturer of power accessories, has been appointed district sales manager of that office, succeeding D. S. Tucker.

N. C. Hoyles has been appointed manager of the Cincinnati branch of the Pittsburgh Testing Laboratory, inspecting engineers and chemists, with offices at 813 Race Street. For the last year Mr. Noyes has been assistant manager of the Pittsburgh Testing Laboratory's New York office.

W. D. Morton, Jr., has been appointed purchasing agent of the Holt Electric Company, Jacksonville, Fla., succeeding C. H. Avery, who recently resigned.

Frank T. Groome has completed the work undertaken by him in connection with the industrial lighting campaign of the Electrical League of Cleveland and has returned to Toronto. Mr. Groome was invited to Cleveland by the Erner Electric Company to aid in organizing and in carrying on a city-wide campaign of education among industrial plant executives. As a member of the industrial lighting committee of the Electrical League, his work was very effective. Mr. Groome is best known as an organizer of the Ontario Association of Electrical Contractors and Dealers in Toronto. Later he organized both the electrical jobbers and the electrical manufacturers of Canada.

F. T. GROOME

Obituary

Harry F. Tate, for a number of years Western manager of the National Conduit & Cable Company, Hastings, N. Y., died in Chicago, March 14.

William F. Reynolds, for the past thirty years on the staff of Lockwood, Greene & Company, Boston, and lately district engineer in the Boston office of the Lockwood, Greene & Company Engineers, died at Quincy, Mass., March 9. Mr. Reynolds was born at Providence, R. I., in 1870, and his early career included work in architectural offices at Lynn and Providence. He was a brother of President Frank W. Reynolds of the engineering organization named above, and had broad executive supervision over various engineering departmental activities of the company at Boston.

Robert W. Nicol, founder of the Capital Electric Company and president and general manager of that concern until two years ago, died Feb. 22 at a hospital in Salt Lake City. Mr. Nicol was born in Quincy, Ill., fifty-nine years ago, and for thirty-five years was identified with the electrical contracting business. He was well known throughout Utah, Idaho and Montana. Mr. Nicol retired from active business two years ago, when the Capital Electric Company was sold to the General Electric Company.

Henry Clyde Parrish, formerly manager of the Southern Berkshire Power & Electric Company, Great Barrington, Mass., died recently after a protracted illness. Mr. Parrish was born in 1876 at West Stockbridge, Mass., and at the age of fourteen entered the employment of the Great Barrington Electric Light Company, working up to the superintendency in 1896. He was made manager when the company was taken over by the Southern Berkshire company, under the management of C. D. Parker & Company, Boston.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Many Plans on Foot to Stimulate Home Building

FROM various sources, for one reason or another, come reports of plans for stimulating construction, particularly of dwellings. Housing shortage, of course, accounts for most of these plans, but a number of them can be laid to the desire to be busy.

Senator Calder's Senate committee on reconstruction has recommended that congressional action be taken by easing building credits, by allowing tax exemption where money is to be used in home construction and by similar provisions. New York State is debating on a bill to promote easier building credits, and New York City has exempted all new domestic building to be undertaken within a year from paying taxes for ten years; one of the largest real estate mortgage houses in the country has reduced its minimum on building loans from $500,000,000 to $200,000,000.

Wages in the building trades are being reduced here and there. Materials prices are very much lower; in fact, in some cases, it is said, the prices have gone to the low limit.

Germans Active in Regaining Foreign Trade

THE great advantage possessed by the Germans in their export market now is said to be the extremely low production costs under which they manufacture. Consequently price basis is the main basis on which they are seeking trade and, indeed, getting it. With this price basis is a liberal system of credits backed up by national banking institutions. German companies are also investing in the business of their foreign customers to enable them to regain their prewar trade.

That the whole country is working to regain its export trade is shown in its constantly increasing volume of exports in the last two years. The electrical industry is one of its main standbys in this respect, and it seems that Germany is endeavoring hardest to undersell Americans in the Latin and South American markets and to undersell the British in the Far East markets. In furthering this there has been effected a co-ordination of important lamp, electrical machinery and raw-material interests in Germany since the ending of hostilities. This has lessened internal competition between these companies but strengthened materially the national competition of all of them working for one common purpose—to obtain trade for Germany.

The Allgemeine Electricitäts Gesellschaft is still extending its sphere of industrial influence. The board of administration has just decided on the increase of the capital stock by another 50,000,000 marks, chiefly for the purpose of acquiring a large interest in the Linke-Hofmann Works of Breslau, builders of all kinds of railroad material and rolling stock. The Linke-Hoffman Works give at present employment to about 16,000 men. In order to reinforce the working capital, and particularly for the purpose of supporting the increasing export trade, the board has furthermore decided to issue preferential shares to the amount of 250,000,000 marks. On account of these transactions the capital stock of the A. E. G. has risen to 850,000,000 marks, of which 350,000,000 marks represents common and 500,000,000 marks preferred shares.

The company has taken over the Felton & Guillaume Karlswerk, and the incandescent-lamp works of the company have been combined with those of Siemens & Halske and the Auer Company, which are now being run under the name of Osram Company. This company practically has the control of the incandescent-lamp production and export. While in the first half of the business year the progress of work was frequently disturbed by strikes and by shortage of coal and electrical energy, in the second half a considerable improvement in this respect and an increased efficiency of the workmen has become noticeable. The Oberspree cable works, near Berlin, have resumed the manufacture of copper cable, and the turbine factory has been employed on the manufacture of several series of large ship engines, especially Diesel oil engines. In the export business an increasing demand for special machinery has become noticeable.

Labor conditions have been reported good by visitors returning from industrial tours of Germany, but press reports of the last few days show that the Communist agitators are fomenting a general industrial strike.

Honesty in Business Necessary to Avoid Depression

THAT every man should be a man of his word, that industry should get back to the condition where an order is an order, that every manufacturer, jobber and consumer should agree not to cancel an order—these were the answers Charles L. Eidlitz, president of R. B. Corey Company, gave to his question "How to Prevent Industrial Depression Again," at the Atlantic Division meeting of the Electrical Supply Jobbers' Association in New York on March 15. Business—and included in that term is the electrical industry—since the middle of last year has been on such a basis that an order was not an order till the seller received a check for his goods and then had it certified. Mr. Eidlitz's characterization was that a man's word in business could not be taken today.

A chart prepared by the speaker showed a business cycle in the following rotation—high prices, surplus of goods, falling prices, bad business, low prices, scarcity of goods, rising prces, good business, then high prices again, and it was in explanation of this business cycle that Mr. Eidlitz made his plea for honesty in business. Everybody now is waiting, even the bank. In many cases the cash-discount man is taking thirty days to pay, the thirty-day man is taking sixty days, and so on, and business is at a low ebb. And while everybody waits business continues to drag along at this level.

Favorable Outlook Seen in British Manufacture

"THE general outlook appears to indicate a time of great activity for electrical manufacturers, with a more satisfactory financial result than in the past, with the proviso that political and industrial stability is maintained and that the supply industry is left free to adapt itself to the new code of area unification." Such was the conclusion of a discussion of the industrial outlook in the electrical industry forming part of the inaugural address of Llewelyn B. Atkinson at London, England, last November on his accession to the presidency of the Institution of Electrical Engineers.

In covering the growth of electrical manufacturing during the past fifty years Mr. Atkinson laid stress on the unification of the cable industry, the only branch of electrical manufacture which was unified, showing its success not only in the home market but also in the world markets,

and he brought out in serious contrast the deplorable commercial and financial condition of the manufacture of machinery and accessories both in home and foreign markets.

"Apart from social, political and labor unrest the manufacturing situation now looks more favorable. There has been a movement of integration," said Mr. Atkinson, "of joining up under single control of sufficient firms to enable complete contracts to be undertaken in any part of the world. The close of the era of constructing small localized generating plants will permit and necessitate standardization, and the increasing size of units will limit the number of newcomers into the industry who, with experience lacking and having the necessity of forcing their way into the market, were a constantly depressing influence.

"The experience of the war production of standard designs, and the increased amount of automatic and semi-automatic machinery as a result of the war, will tend to specialization on the part of those making small machines and accessory apparatus, thus to a certain extent eliminating competition, but, as the result of the increased production of a limited range of standard articles, diminishing the cost below what the previous competitive cost would have been."

Jobbers' Purchaser Compiles Prices on Electrical Materials

AN INTERESTING card of price comparisons on various lines of electrical supplies and material has been made up and distributed by the Biddle Purchasing Company, 107 Chambers Street, New York City, to its clients—jobbers for whom it acts as purchasing agent. The chart shows jobbers' buying prices from 1914 to January, 1921, the high and the low figures being given for each year.

It is understood that only prices representative of all the manufacturers of any given line have been used. Where one manufacturer may have doubled lists and the majority of manufacturers have not done so, the figures of the majority have been taken.

Carbon Industry Needs Tariff Protection

ALTHOUGH the carbon section of the Associated Manufacturers of Electrical Supplies has been active in its endeavor to get greater tariff protection on the importation of foreign carbons and carbon products, the desired results have not yet been achieved. On Jan. 11 A. C. Morrison of the Union Carbide & Carbon Company, representing the carbon section, received a hearing before the committee on ways and means of the House of Representatives. At its conclusion he filed with the committee data relating to foreign wages in carbon manufacture, a schedule of the suggested rates of duty on electrial carbon products and a brief suggesting the change in wording which might be used in this matter as opposed to the wording in the present schedule.

Manufacturers of electrical carbons and carbon products have always been confronted with difficulties in their endeavor to obtain information on undervaluation of these materials when entering this country as imports. But in this respect the industry has made some progress in the gathering of such information.

The speaker showed some of the methods by which importers paid a relatively light duty on arc-light carbons, motion-picture carbons, searchlight carbons, furnace electrodes, brushes, miscellaneous carbons, turbine packing rings and telephone carbons because of Supreme Court interpretations placed on the wording of the tariff rules. Particular emphasis was placed on German goods and the returning market which that country was finding in the United States through low tariffs and through low production costs. German carbon workers were said to average $3.90 per week against $31 per week in the States.

Before the war there were imported principally from Germany, 17,000,000 motion-picture carbons per annum. During the war American industry filled these requirements, and now 20,000,000 are needed. Last October 1,100,000 came in from Germany, and an order was placed in Germany early in January, 1921, for $1,000,000 worth. On a cost basis this importation will continue and will supply the whole field unless proposed tariffs are enacted.

ARTICLE		1914		1915		1916		1917		1918		1919		1920		1921
		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	JANUARY.
Batteries, Dry*	EA.	12¢	14¢	14¢	24¢	20¢	21½¢	21¢	24½¢	24½¢	27½¢	27½¢	27½¢	27½¢	30¢	30¢
Bells, Electric 2½" Class C	EA	15½¢	16½¢	16½¢	16½¢	22¢	27¢	14½¢	27¢	29¢	37¢	32¢	37¢	37¢	37¢	46¢
Blades, Hack Saw, 6" Star	GRO.	$2.30	2.30	2.30	2.30	3.47	3.53	3.53	5.15	5.07	5.07	5.07	5.07	5.07	5.07	5.07
Boxes, Outlet		50-7/10-5%	60-10-10%	60-4/10-5%	50-4/10-5%	78%	64%	62%	45%	67%	45%	60-10%	55%	45%	40%	40%
Boxes, Switch		50-4/10%	60%	50-4/10-5%	50-7/10-5%	64%	53%	64%	60%	60%	50-10%	65%	56%	52%	40%	40%
Bushings, Socket, ⅛"	M	$1.00	1.05	1.05	1.05	95¢	1.05	1.15	1.50	1.50	1.50	1.50	2.25	2.50	3.00	3.00
Cable, Bx #14 2 Wire	M FT	$35.00	45.00	38.00	50.00	50.00	60.00	62.50	75.00	60.00	70.00	60.00	75.00	60.00	90.00	55.00
Conduit ½" Black		71%	65%	69%	68%	67%	54%	52%	22%	26%	22%	30%	26%	28%	20%	31%
Copper, Electrolytic	LB.	11-3/4¢	14½¢	13¢	23¢	23¢	36¢	23½¢	37¢	23¢	26¢	14⅞¢	23½¢	12½¢	18½¢	12¾¢
Cutouts, Electric		70-10-10%	70-10-10%	70-3/10-5%	70%	60%	60%	55%	50%	50%	40%	40%	40%	40%	35%	45%
Drivers, Screw, Perf Hdle		60%	60%	60%	60%	60%	50-10%	50%	40-10%	40-5%	40-5%	40-10%	40-10%	40-5%	30-5%	30-5%
Fuses, Enclosed		80%	75-10-5%	80%	75-10%	75-10%	75%	75-10%	63%	75-10%	65%	75-10%	70-10%	70-10%	70%	70%
Iron, Pig, Basic Valley	TON	$12.48	13.21	12.50	17.73	17.69	30.00	30.00	53.52	32.00	33.00	25.29	34.25	33.00	48.50	32.00
Knobs, Porcelain		75-10-10%	75-10-2½%	35-10-10%	65-10-10%	75-10-10%	60-10%	61-10%	46-10%	46-10%	40-10%	65-7½%	30-10%	30-10%	20-10%	20-10-5%
Lead, St. Louis	CWT	$3.35	3.75	3.50	7.50	5.45	8.25	5.42½	12.00	5.70	7.75	4.60	7.50	4.45	9.50	4.75
Loom, Circular		80-10%	75-10-10%	80-5%	75-10-10%	75%	66%	70%	50%	65%	50%	75%	55%	55%	50%	65%
Plugs, Attachment, #903	M	$72.50	80.00	80.00	90.00	80.00	90.00	82.50	90.00	95.00	95.00	95.00	113.00	110.00	113.00	110.00
Plugs, Fuse	M	$17.00	18.50	17.00	18.50	19.75	35.00	32.00	35.00	32.00	40.00	33.00	40.00	38.00	42.00	36.00
Rubber, Up River Fine	LB	16¼¢		20¢		18½¢		27¢		27¢		24¢	50¢	12¢	28¢	11¢ TO 12¢
Schedule Material		60%	58%	62%	60%	54%	47½%	47½%	40%	40%	30%	40%	30%	30%	24%	24%
Solder 40/60	CWT	$14.20	15.00	15.02	27.37	18.30	27.35	20.30	41.75	31.75	48.83	24.68	33.80	15.47	31.70	16.25
Spelter, New York	LB	4¾¢	6¼¢	5¾¢	27⅞¢	8⅛¢	21⅛¢	7¾¢	11¢	6⅞¢	9⅞¢	6¢	9¢	5½¢	9½¢	5⅝¢
Switches, Snap		62%	60%	62%	60%	54%	47½%	47½%	40%	40%	30%	40%	30%	30%	24%	24%
Tape, Friction	LB	16¢	17¢	16¢	17¢	16¢	17¢	19¢	24¢	24¢	38¢	33¢	35¢	40¢	50¢	50¢
Tin, Straits, New York	LB	28½¢	65¢	32¢	57¢	37⅛¢	56¢	42½¢	86¢	70¢	110	52½¢	72½¢	33½¢	62¼¢	33¼¢
Tubes, Porcelain		85-9/10%	85-9/10%	85-9/10%	85-10-5%	85-9/10%	85-10%	80-3/10%	70-10%	80-3/10%	65-10%	80%	66⅔-10-5%	60-10%	50-10%	50-10%
Wire, Annunciator	LB	13½¢	14¼¢	14¼¢	21¢	23¢	35¾¢	17¢	34¾¢	27¢	35¼¢	23½¢	36⅛¢	26½¢	42¢	26¢
Wire, Copper Bare	LB	14½¢	15¢	14¾¢	23½¢	29⅛¢	35¾¢	26¼¢	37½¢	22¾¢	29¢	17¢	26¾¢	18¢	23¢	15⅝¢
Wire, Rubber Covered	M FT	$5.85	5.90	5.75	8.90	8.65	13.40	9.10	10.35	8.85	10.25	8.25	10.75	8.00	10.75	7.75
Wire, Weatherproof	LB	13½¢	14¼¢	14¼¢	21¢	23¢	35⅝¢	26¾¢	34½¢	26¼¢	30½¢	18½¢	29¢	16½¢	25¾¢	17¢
Wrenches, Pipe, Stillson		80-5%	80-5%	80-5%	80-5%	80-5%	75%	70-10%	70%	66⅔%	66⅔%	70%	66⅔%	66⅔%	47½-25%	55-25%

WHAT JOBBERS HAVE HAD TO PAY FOR ELECTRICAL SUPPLIES IN LAST SEVEN YEARS

Low Cotton Price Holds Back Southern Industry

A NUMBER of interesting facts were disclosed at the meeting of the Georgia Bankers' Association held in Macon on the twenty-third of March. This meeting developed the fact that 50 per cent of last year's cotton crop was still in the hands of the farmers who are holding it, with no definite price or date of selling in view. It also appears that the reduction in acreage will be 33 per cent and that only 38 per cent of the fertilizer used last year will be used this year. Banks will curtail their farm loans very sharply and will loan only where the money will be used for the production of food crops and where reasonable collateral is forthcoming.

A review of these facts makes it evident that an increase in the price of the staple will inevitably mean increasing activity, but that until the farmers dispose of some of their holdings from last year business will continue to be slow in the rural districts throughout the section. The fact, however, that a great deal of the agricultural wealth is still held indicates that even though the revival may be slow, conditions are, nevertheless, on a sounder basis than was heretofore supposed.

Present cotton prices in Augusta, Ga., are quoted at 11.25 cents a pound. During the war, when cotton was selling for 40 cents, the planters couldn't grow enough. Even with cotton at 20 cents it is felt that there would be considerable activity in that commodity, with resulting activity in all industry in the cotton belt. With money flowing in that region there is a nice volume of extension of electric service projected, but as conditions now stand it hardly seems that much reawakening of industry can be expected at present cotton prices.

Manufacturers of electrical apparatus and supplies are still carrying many Southern jobbers, who in turn are carrying their trade. The money just isn't liquid, and each branch of the industry in turn is bearing its share of the burden until such time as the market again opens up. This practice is saving liquidations.

Exchange Market for Used Washers and Cleaners

IN VIEW of the slowing up of the appliance market it is interesting to note that many dealers in the Middle West are increasing their sales of new washers and cleaners by making allowances on used machines. In some cases customers are approaching the dealer with the proposition that they will buy provided an allowance is made them on their old machine. In a far greater number of cases solicitation at the house discloses the same condition. In virtually every instance the dealer is making a profit on both machines, the profit on the whole transaction being considerably larger than it would have been on the sale of the new machine or cleaner only.

So far this factor probably does not greatly affect the industry, but there is approaching a time when the demand curve for washers and cleaners will tend to flatten out, and at that time the question of the acceptance and disposal of used machines will have to be considered seriously. At present the average dealer finds no difficulty in repairing and disposing of machines taken in trade. The services of one repairman and the occasional use of newspaper space suffice to keep this end of the business going at a pretty fair rate.

As the market approaches the point of saturation a more complicated system of merchandising will have to be used. In the used-automobile business, it is understood, standards of value are set by a bureau which tabulates from week to week the supply of the various makes of cars and the relative values of certain models, depending on condition. These values are bulletined to the members of the bureau, and nearly all of their transactions are based on the bulletins. Some procedure of this kind may have to be organized by washing-machine dealers. Co-operation of manufacturers, it seems, will be a necessity also if the consumer market for new machines is to be kept healthy, inasmuch as the average dealer does not possess the facilities to repair and dispose of a large number of used machines. There is another parallel in the automobile industry, several Detroit manufacturers maintaining salesrooms to dispose of used cars of other makes taken in by their dealers.

How Should Washing Machines Be Rated?

EFFORTS are being made by the educational department of the American Washing Machine Manufacturers' Association to have the rating of washing machines expressed in pounds of clothes, dry weight, instead of in number of sheets as at present. It is the contention of this department of the association that the present method of rating is misleading, inasmuch as sheets do not form a particularly large percentage of the average washing and the user gets only a very vague notion of the true capacity of the machine from the term "number of sheets."

Another point made by the department is that rating as expressed in pounds of clothes will enable the housewife to determine the exact amount of water to use with the amount of clothes to be washed. This would insure proper cleansing of the clothes and would eliminate poor washings resulting from too much water in proportion to clothes and the damage to clothes and washer due to overcrowding. Economies in the use of soap and washing powders also would result. Whatever can be done to make it easier to use the washing machine will of course redound to the benefit of the industry.

The Metal Market Situation

STEPS leading to a further drastic cut in copper production have now been taken, and as a result several large mines have closed down entirely. This factor in the market, together with the firm price stand that has all along been taken by large producers, has brought about a decidedly firmer tone. Prices have advanced about ¼ cent since last week's report, and the minimum quotation for prompt delivery is now 12.50 cents. Large producers are still holding to prices of 12.75 to 13 cents per pound for copper delivered over the next two to three months and are reported to have made sales at these figures. Consumers have apparently decided that nothing is to be gained by holding off longer from covering their needs, and as a result domestic buying interest is decidedly greater. Whether this is but a temporary condition it is, of course, yet too early to say. The Anaconda Copper Mining Company is the latest one to announce temporary suspension.

Following the expectation the prevailing low "official" price of lead was advanced to 4.10 cents, inasmuch as a 4-cent price has been below the effect of foreign competition and the outside New York market is about 4.45 cents per pound. Zinc is also regarded as a good buy at its present level, but money stringency has prevented consumers from taking advantage of this price extensively.

NEW YORK METAL MARKET PRICE

	March 22, 1921	March 29, 1921
Copper	£ s d	£ s d
London, standard spot	68 0 0	69 12 6
	Cents per Pound	Cents per Pound
Prime Lake	12.37—12.62	12.75—13.00
Electrolytic	12.00—12.50	12.50—12.75
Casting	11.75	12.00
Wire base	15.00	15.00
Lead, trust price	4.00	4.10
Antimony	5.37	5.12
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	11.00	11.00
Zinc, spot	5.20	5.15
Tin	28.50	29.25
Aluminum, 98 to 99 per cent	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50—10.00	9.50—10.00
Brass, heavy	5.75— 6.00	5.50— 5.75
Brass, light	4.00— 4.25	4.00— 4.25
Lead, heavy	3.12— 3.62	3.12— 3.62
Zinc, old scrap	2.78½- 3.00	2.78½- 3.00

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

SEVERAL districts report a little better tone this week. New York, Chicago, Boston and San Francisco appear to be leading in new construction projected and in some cases let. Most of this is for residential work, however. In the other territories there is no evidence of any less activity, but conditions seem to indicate a waiting policy.

Except here and there locally, prices have shown no change this week. Stocks in general are ample to fill present needs, and all the trade is doing is to keep these stocks in a balanced condition. There is quite a movement of supply items, however, because contractors have a fair amount of replacement and repair work on hand. The feeling of optimism is a little bit more noticeable as the warm weather puts in an appearance.

While there is no evidence that money is any easier to collect, it is no harder. Constant application on this question is keeping most payments from going below the level of the last few months.

NEW YORK

A slightly better tone to trade can be reported this week, and in some instances a little improvement in demand is noted too. There is nothing big under way and total sales would probably not show much increase over the past few months, but spring is here, bringing a certain amount of seasonal buying, and an increasing number of plans for new buildings helps to brighten the horizon.

There is a fairly consistent volume of goods moving, but not in large quantities, and the source of buying differs among various jobbers.

Stocks are fairly low on standard items, yet jobbers are still endeavoring to lighten inventories further. As a consequence buying from the manufacturer is only such as sales are thought actually to warrant. Prices have remained unchanged the past week, and collections, while fairly satisfactory, are pushed closely.

Non-Metallic Flexible Conduit.—On 1,000 ft. of the ½-in. size the market ranges from $22 to $23.10, and for ¾-in. from $24 to $25.15, though as high as about $6 per 1,000 ft. above these prices is held in some quarters. Demand is not large.

Rubber-Covered Wire.—No. 14 single-braid holds at $7.75 to $8.25 per 1,000 ft., but more jobbers are now quoting the bottom price. Stocks up to half a million feet are reported this week. A few jobbers are making fairly good sales, but general demand is not brisk.

Flexible Armored Conductor.—Several jobbers report that demand has picked up and is fairly good, but this condition is not yet general. Good stocks are on hand, with No. 14, two-wire, double-strip sold at $63 to $65 per 1,000 ft.

Conduit.—Competition among jobbers has had the effect of lowering the market as several houses are this week well under the mark of $70 per 1,000 ft. on ½-in. black. On that size quotations range from $63.60 to $70 in 2,500-ft. lots, and on ¾-in. black in the same quantity from $83.75 to $93.50.

Tape.—Standard grades of friction tape bring from 42 to 47 cents per pound in 100-lb. lots, and rubber tape from 40 to 48 cents. The average market is about 45 cents per lb. on both friction and rubber. Demand, though not great in general, is spotty among different jobbers as some are selling considerable to industrials and to contractors for small repair jobs. Stocks are fairly large.

Schedule Material.—Stocks are well filled on standard items, and jobbers for the most part are ordering only as they need the material. The view that prices must ultimately come down persists. Sales are only fair.

Fans.—An early spell of warm weather has started supplies moving very slightly, but early orders placed with jobbers are small. Indications are that the fan business in this territory will be on a conservative basis all through the trade, especially as stocks carried over are large.

Vacuum Cleaners. — Demand is spotty. Some jobbing houses and retailers state that spring demand has increased sales to good proportions, while others report a poor market. Buying from the manufacturer is cautious; in fact, several jobbers have such large stocks they expect to order no more cleaners this season.

Lamp Cord.—No. 18 cotton parallel in 1,000-ft. lots sells for $18.75 to $24.55, and No. 18 cotton twisted from $16.50 to $20.70, though in both instances the higher quotation is considerably above the average market price.

CHICAGO

The steady stream of building permits keeps up, $1,426,000 being the figure for the past week. A large proportion of this is going into cottages and small apartments, and the total for March and February is so great that much activity in contractors' supplies is assured. While no actual boom is under way, the total of new construction so far this year exceeds the average for the past ten years and bids fair to keep up this pace for some time.

The Illinois State Legislature has initiated an inquiry into the construction situation in Chicago, it having been stated that conditions similar to those uncovered in the New York investigation are existent here and that building is thereby being greatly retarded.

Electrical trade remains in the same quiet stage that has been reported for some weeks. No price changes are noted and purchases are limited to actual requirements in all cases. Construction work is not yet far enough advanced to cause any pressure of buying, and general retail lines remain quiet on account of widespread non-employment. The employment situation, however, is gradually improving as the automobile interests are increasing their forces, and, in general, manufacturing activity seems to be upward.

Bare Copper Wire. — Slightly increased demand is in evidence, and sellers show less willingness to shade quoted prices, probably because it is now about as low as it can get. Thousand-pound lots of No. 8 are quoted at 16 cents. Supply is ample, but no reports of overstocks are heard.

Insulated Wire.—With a cessation in the tendency of prices to slide lower every day demand has stiffened up somewhat. With the volume of construction that is in sight it is evident that quantities of insulated wire will be needed this summer, and buyers who figure that the bottom has been reached are coming into the market. No change in quotation has been made, No. 14 rubber-covered still being $7.75 per 1,000 ft. and No. 6 triple-braid weatherproof 19 cents per pound in 1,000-lb. lots.

Conduit.—Continued speculation as to the future of steel prices makes a poor market on pipe, prospective buyers apparently being willing to gamble on lower prices coming. In 5,000-lb. lots, $64 per 1,000 ft. is the quoted price on ½-in. black.

Flexible Armored Conductor.—Lack of orders is not inducing any appreciable amount of price cutting, No. 14, two-wire holding around $62 per 1,000 ft. in 5,000-ft. lots.

Fans.—Purchases of fans are so far very conservative. Prices hold no promise of a further reduction, and interested parties are content to stock just enough to meet current requirements and await developments.

Motors.—There has been some increase in inquiries in the past week. It is not felt that any very active demand will develop as, in this territory at least, there will have to be a considerable improvement in general business before present installations are kept busy.

Lamp Cord.—Sufficient stocks and fair business is the report from all factors. No. 18 twisted-cotton-covered is quoted at $15 per 1,000 ft.

BOSTON

A gradual improvement in jobbing trade is apparent, despite the continued handicap of the local building strike. One of the larger houses reports that its total billing for the first quarter of 1921 will be within 94 per cent of last year's billing for the same period. Building and engineering contracts in New England for the week ended March 22 are published as $4,097,300, exceeding all but one corresponding week since 1912. The unsatisfactory labor situation is the chief obstacle to an early return to prosperous trade conditions as far as the local construction field goes. Announcements of new industrial-plant construction are beginning to be played up in the press. Jobbers' stocks are running low and in many cases orders are being passed along to the manufacturer in the form of calls for replacing existing stores. Collections are poor this week, prices steady and deliveries generally satisfactory.

Wire.—Rubber-covered No. 14 sells at $8 per 1,000 ft. in 5,000-ft. lots and at $7.75 in 25,000-ft. consignments. Weatherproof base is 17 cents and bare base 16½ cents except in very large quantities, when about 15½ cents is figured. Little wire is moving compared with normal.

Fuses.—Stocks are easy, plugs up to 30 amp. at 110 volts bringing 5.1 cents in standard-package lots.

Motors.—Stocks are well filled and deliveries easy. A few motors are being sold and some inquiry work is being handled. Betterment work in industrial plants is absorbing some machinery of the motor-driven type, and rearrangements of old drives are receiving more attention.

Flexible Armored Conductor.—Good supplies are in hand and current sales are moderate, No. 14 double-strip bringing $87 per 1,000 ft. in 1,000-ft. lots.

Knobs and Tubes.—Moderate sales are taking place on a hand-to-mouth basis. No trouble is encountered in meeting current needs. "Nail-it" knobs are selling at $27 per 1,000 in barrel lots and 3-in. tubes at $9.50 per 1,000, same lots.

Appliances.—Local stocks of vacuum cleaners, radiators, flatirons and washers appear equal to anticipated spring demands. Energetic sales work in the retail field is proceeding, and washers and cleaners are moving fairly well. Considerable radiator business is anticipated shortly with the stopping of domestic heating plants. Competition among cleaners is keen at present.

Lamps.—Lengthening days have affected trade adversely but stocks are diversified and portable units are moving slowly.

Non-Metallic Flexible Conduit.—Prices are steady and stocks are not being drawn down sufficiently to lengthen deliveries much. The 3/32-in. size sells at $22 per 1,000 ft. in 5,000-ft. lots, and the 7/64-in. size at $24.

Storage Batteries.—Starting and lighting batteries are moving fairly well, the mild winter having kept many more cars in service than ordinarily. No complaints as to deliveries are heard. Tractor and truck batteries are relatively inactive, although inquiries are promising. From two to three weeks' deliveries are quoted.

Starting and Lighting Sets.—The improved conditions in the automobile industry are reflected in a better demand for this equipment. One New England manufacturer received an order for about 30,000 sets recently, and improved manufacturing plant will probably result in completion of the order in not far from four weeks.

ATLANTA

A canvass of jobbers disclosed a slight improvement in their business as a whole. Spring weather seems to have set in in earnest and is causing a general feeling of optimism which is reflected in the receipt of more inquiries than for some time. The constant demand for housing facilities is stimulating business activities, and building permits in the larger cities are showing a healthy increase over prior months. This has served to stimulate the production of lumber and many lumber mills which have been shut down are planning for early reopening.

Vacuum Cleaners.—The usual spring demand for this specialty has caused considerable increase in sales, and at the present rate stocks will be shortly depleted and jobbers forced to place reorders with manufacturers. Shipments are reported very good.

Rectifiers.—A slight improvement in the automobile trade has served to stimulate the interest in battery rectifiers, particularly in the 6-amp. size. Stocks are in good shape and prices on the 6-amp. size are steady at $130.

Interphones.—The completion of a number of office buildings and apartment houses in Atlanta and neighboring cities has caused a brisk movement in interphones. Jobbers' stocks are reported in excellent shape, with no immediate price reductions is prospect.

Non-Metallic Flexible Conduit.—While the movement in this line is still very sluggish, a slow increase in buying is to be noted, despite the rumor of another decline in price. All jobbers have heavy stocks on hand. Prices, lots of 1,000 ft. to 2,500 ft., 3/32-in., $2.75; 7/64-in., $3 per 100 ft.

Bell-Ringing Transformers.—Educational advertising and the revival of residential building are credited with increasing sales of this item. Local stocks are reported in good shape in all sizes. Price, list, 3, 3-in. gong size, $2.50; 12, 4-in. gong sizes, $6.50.

Conduit.—Galvanized pipe is showing an awakening activity and enameled is reported as quite steady. Jobbers are not buying heavily, expecting a further reduction in price, and as a result stocks of the popular sizes have become quite spotty. Prices per 100 ft., galvanized, ¼-in., $9.17; 1-in., $18.00; 2-in., $39.18. Black, ¼-in., $8.66; 1-in., $16.98; 2-in., $36.96.

Lightning Arresters.—The approaching summer season has brought with it a brisk movement of arresters—particularly of the 2,300-volt type. This movement, it is felt, will continue until well into the middle summer. Stocks are in good shape and shipments satisfactory.

Street-Lighting Equipment.—Dormant for a considerable period, this line is now showing considerable activity, most of the inquiries coming from municipalities for both the standard and ornamental type.

ST. LOUIS

The situation this week is unchanged, there being a steady and gradually improving demand. Of the recent inquiries for pole-line materials one has developed into the actual placing of orders for materials to erect a 22-mile transmission line, and it is felt that this is but the beginning of a fair amount of pole-line construction work which will be done this spring and summer. Stocks remain generally in good condition except that they are heavy in porcelain and schedule material and slightly short in safety switches and high-tension insulators. No price changes are noted for the week. Collections are perhaps slightly better, ranging as a rule from forty-five to sixty days. One jobber reports collections on a seventy-five-day basis, though with signs of betterment.

An interesting sidelight on the general business condition here is that the output of central-station energy this year has at no time been less than the output of the corresponding month last year. In comparison with reported reductions elsewhere this would seem to indicate that St. Louis is suffering less from the industrial depression than are many other sections of the country.

New construction work, however, is at a very low ebb. Building permits are few and for small amounts. There are reported to be a number of buildings, both residential and industrial, under contemplation and awaiting chiefly a reduction in labor costs. The dispute between the contractors and the building trades unions is still far from settlement.

Wire.—No marked change in either the demand or the supply of wire has occurred this week. Fair movement is maintained and stocks are in good condition. No. 14 rubber-covered is the best seller and is priced from $7.90 to $8.10 per 1,000 ft. in 5,000-ft. lots. It is quoted as low as $7.50 in 100,000-ft. lots. Weatherproof is being sold in some instances on a 16-cent base and bare copper from 15½-cent to 16½-cent base.

Safety Switches.—As a result of the recent ruling on in-

closing of switches and of its strict enforcement, there has been a good demand for safety switches and local stocks are becoming in some instances depleted. Jobbers are buying conservatively, however, and stocks will probably be maintained at a low figure for some time but with frequent turnover. No changes in prices have been reported.

Sockets.—Generally heavy stocks obtain and the demand is exceptionally low, this being largely attributable to lack of residential building. Pulls are quoted at $51, keys at $28 and keyless at $25.50 per 100.

Poles and Cross-Arms.—Demand is just beginning to appear in these items, the first sale of consequence for some time being reported this week. A good demand for pole-line materials this spring and summer is expected by the jobbers as inquiries are numerous and for large quantities. Cross-arms are approximately 25 per cent lower than on Jan. 1, and pole-line hardware is about 10 per cent lower. Stocks of these items are in good shape.

Porcelain Insulators.—There is a shortage of porcelain insulators for high-tension work, due to slow deliveries by the manufacturers, sixty-day deliveries now being offered.

Rigid Conduit.— While the city's ruling against open wiring is tending to stimulate sale of conduit, this has not yet been made an ordinance, so that it may be a month yet before demand will increase materially. Stocks are in good shape, ½-in. black being quoted from $65 to $71 per 1,000 ft.

SAN FRANCISCO

A great deal of building is reported in the residential section. Large building, however, is mainly restricted to jobs well under way and few permits are being issued for this class of construction. Appliance buying is well nigh at a standstill, all classes of materials from the small socket appliances up to washing machines and ironers being affected. This seems to be the result of the determination of individual housewives to await lower prices, which they deem certain. In this opinion they are confirmed by the reduction in price of a number of low-grade machines.

Rubber-Covered Wire.—Prices are still on the decline, the latest level reached being $8.95 for No. 14 single-braid solid in coil lots, with a price 90 cents per 1,000 ft. lower in 5,000-ft. lots. Assortment with other sizes is permitted. Local stocks are good, and the buying is in rather large quantities. Several dealers have assorted their purchases so as to bring out carload lots from the East, placing their orders directly with the manufacturers.

Conduit.—Pipe is now selling in 10,000-lb. assorted quantities at a price approximately 12 per cent below previous figures. A new price schedule eliminates the smaller quantities such as the 2,500-lb. and 5,000-lb. quantities and provides for just three prices—less than 10,000 lb., 10,000 lb., carload lots. Jobbers' stocks are good in all sizes and finishes. They are not heavy despite the decreased demand because they have been reduced proportionately by the cancellation of certain pre-scheduled shipments.

Non-Metallic Flexible Conduit. — A startling slash in prices is just published, the price of ⅜-in. dropping from about $40 per 1,000 ft. in crate lots to $26. A new 5,000-ft. price averaging about $1.50 per 1,000 ft. lower is being quoted. This wiring staple was short nearly all last year, but when the factories caught up to their quotas they did it so rapidly that rather heavy jobbers' stocks are reported.

Lamps.—This is the quiet season for lamp sales, but keen competition for outstanding contracts is the rule. Quite a few electrical businesses are reported as changing hands, and this has occasioned many cancellations of lamp contracts and their consequent replacement from other sources. The illuminating educational campaign is being vigorously followed, but so far the results have not made themselves greatly felt commercially.

Ranges.—A drop in price of approximately 30 per cent has just been wired to the Coast, and new prices have not yet been exactly figured. From present indications it looks, however, as though the standard household range will retail for about $150. An immediate result of the drop was the stimulation of orders from power companies.

SEATTLE—PORTLAND

Unmistakable signs of business revival predominate, but actual business is not materializing; consequently the electrical trade is marking time awaiting the improvement predicted and anticipated. There is quite a general feeling that if labor would voluntarily grant a wage reduction it would have a greater effect than any other one thing in reviving business conditions. The wage earner is not buying because he is expecting a wage cut or the loss of his position.

Sales in Seattle and Puget Sound cities are very light, the principal movement, such as it is, being on certain domestic appliances and wiring devices. There have been no recent price changes of consequence and none is expected. Stocks are topheavy and virtually every line is easily obtainable. Collections are from fair to medium, and no new credits of moment are being asked for or extended. Employment conditions in Seattle and Sound cities are showing improvement, but wage cutting is an every-day occurrence. In an effort to stimulate building the Tacoma master builders' association and the Everett association announced wage cuts approximating 20 per cent effective May 1 and April 1 respectively. Seattle's wage cut of 20 per cent is in effect, and Portland builders will follow suit at once, it is understood. Manufacturers in the Portland district report business very spotty. Jobbers say that business in general is very slack, the principal activity being in copper wire and wiring devices. A few minor price reductions are reported for the week, but porcelain continues to show an upward tendency. Collections and credits remain virtually unchanged, the average of collections for Portland being about fifty days.

Motors.—For the first time in nearly two years stocks of fractional-size motors are in excess of demand and replenishments are very easy to obtain. The movement of larger sizes is negligible, as many lumber mills and manufacturing plants which contemplate electric installations have postponed work.

Knobs, Tubes, Cleats.—Stocks on hand are comparatively heavy, and demand is not showing the increase anticipated. Prices are holding.

Lamps.—All dealers report stocks ample and deliveries easily obtainable. Demand is showing little improvement.

SALT LAKE CITY—DENVER

As the time approaches when building activities should normally begin there are few big jobs scheduled for immediate work. Co-operative efforts on the part of all who contribute to building either in materials, skill or rough labor are being put forth in the hope that some sort of building campaign may be launched. Realtors on their part are also spending huge sums to spread the idea that this is the logical time to erect homes. That substantial results will accrue from this concerted drive on the prospective home builder and others no one doubts. Lumber is advertised as being back to a pre-war basis, hardware shows substantial reductions, and plumbing and heating costs are cut from 25 to 30 per cent from the level that was maintained for several years past. The financial situation continues conservative. The banks report the demand for money to be strong as ever, with little to be had. Country banks are reported cutting down their loans to absolute necessities, notifying city banks that there can be no lasting relief until farmers are able to market their products. High price of labor is one of the factors that stands as a hindrance to building. High wage schedules are maintained, despite the fact that thousands of men are now unemployed.

Wire can be had in plentiful supply from jobbers. The chaotic condition of the metal market holds the prices down to a low level.

Conduit is also affected seriously by the condition of the metal market. Orders can be filled for immediate delivery. Porcelain stocks are ample to meet present needs. Most back orders are now taken care of by manufacturers. The price shows no tendency to come down, quotations being about what they were a year ago. The status of sockets is about the same as that of porcelain, while the outstanding feature is the persistence of the high price level.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Richmond Picked for Credit Association Meeting

The twenty-second annual meeting of the National Electrical Credit Association will be held in Richmond, Va., on May 19 and 20, according to a recent advice from headquarters in Chicago. The name of the meeting place has not been decided upon to date, and this along with the program will be announced later. This meeting city, it seems, should permit of a large attendance from the states in the South.

Washing-Machine Makers Issue Laundering Data

Six bulletins dealing with the subject of home laundering have been issued by the American Washing Machine Manufacturers' Association for the use of domestic science courses in colleges, women's clubs and extension courses. The bulletins deal respectively with removal of stains, supplies for the home laundry, washing cottons, linens, woolens and silks, machine washing, ironing and the layout for the equipped home laundry.

Supply Jobber Adds Residential Fixture Studio

The F. Bissell Company, Toledo, Ohio, jobber of electrical supplies, will open an electric lighting fixture studio in the Locke residence at Madison and Thirteenth Streets. The residence will adapt itself readily to the display of fixtures actually seen and hung in a room corresponding in general with that in which they are to be used. E. R. Gillett, manager of the lighting-fixture department, will be manager in charge.

McKenney & Waterbury Embark in Jobbing Business

The McKenney & Waterbury Company, Inc., which was recently organized through the acquisition of the old McKenney & Waterbury Company, Boston, by Murvyn W. Vye and Alfred J. Paine, has extended its activities into the general field of electrical supply jobbing.

Arrangements are being made to represent various manufacturers of electrical household and industrial equipment. Among the lines which will be carried at once are National metal molding, H. T. Paiste taplets and other material, Hart & Hegeman wiring devices, Square D switches, and pole-line hardware, insulators, crossarms, etc. Various changes in the offices of the company have been made to render the executives and sales staff more accessible to visitors and customers, and a wiring device stock department has been established on the first floor.

Holt Power Equipment Enters Construction Field

The Holt Power Equipment Company, Milwaukee, Wis., which has been specializing in the purchase, sale and reconstruction of generators and motors, will hereafter and in addition to its present activities engage in electrical engineering, construction and maintenance work, particularly in connection with industrial light and power installations. Ottomar H. Henschel has become financially and actively associated with Dean S. Holt of this company.

Northwestern Electrical Equipment Changes Location

The building at 379-383 Washington Street, New York City, has been leased by the Northwestern Electrical Equipment Company, at present at 35 Vesey Street. The old location is only 25 ft. x 90 ft., six floors and basement, while the new building will be 60 ft. x 60 ft., five fioors and basement. The company expects to have better shipping facilities from now on and to be able to provide better service in the supply jobbing field. The change must be made by May 1 as the present building has been sold.

Michigan Stamping Purchases Toledo Metal Products

The Michigan Stamping Company, Detroit, has recently purchased the business of the Toledo Metal Products Company, 1627-33 Dorr Street, Toledo, Ohio, and will continue the manufacture and sale of the "BG" line of outlet boxes, covers and switch boxes formerly made by that company. The Michigan Stamping Company business history covers a period of over twenty years until it has reached a capitalization of $4,000,000.

The present plant of the Michigan company in Detroit covers 6½ acres on a 36½-acre site. The work of moving the newly acquired electrical department equipment from Toledo to Detroit is well under way, and it is expected that permanent production in Detroit will be commenced early in May. A new floor, 480 ft. x 60 ft., is now under construction to care for part of this new manufacturing. Meanwhile some production is going on at 1631 Dorr Street in Toledo. John H. French is president, H. P. Cope is vice-president, W. F. Tant is secretary and treasurer, and A. B. Hoffman will be in charge of the newly acquired electrical department.

Westinghouse Lamp's Bloomfield Plant About Ready

The new Bloomfield (N. J.) plant of the Westinghouse Lamp Company is about completed. Started last spring, the work has progressed steadily. The expansion consists of 230,014 sq.ft, part of which is an extension and the remainder an entirely new building of four stories. Ground measurements on the extension are 164 ft. x 100 ft. and 94 ft. x 80 ft. On the new building they are also irregular, 550 ft. x 100 ft. and 466 ft. x 100 ft. New quarters will be provided for the commercial and general engineering departments, for finished stock, for a special lamp manufacturing division equipped to put out 5,000 special lamps a day, and for shops, etc. On the roof of the new building is a long-range wireless telephone outfit.

Progressive Electric Products Company Changes Name

Because of the similarity of the name The Progressive Electric Products Company to that of other companies, this company recently changed its name to The Electric Heat Control Company. It is located at 2711 Church Avenue, Cleveland. There has been no change in directors, officers or in manufacturing. The "King" bell-ringing transformers are being made by this company.

Sherman Law Upheld in Phonograph Record Suit

An action under the Sherman law was won by R. H. Macy & Company, New York City, this past week in which that company's claim that the Victor Talking Machine Company had refused to sell it phonograph records was upheld by Judge Mack in the federal court. This, it is alleged, caused the plaintiff financial loss from 1914 to 1917. The verdict returned grants the Macy company $49,698, which under the Sherman anti-trust law will be trebled. An appeal will be taken, it is reported.

Refractories Association Re-elects Former Officers

When the Refractories Manufacturers' Association held its annual meeting in New York, on March 16 to 18, these officers were re-elected: J. D. Ramsey, Elk Fire Brick Company, St. Marys, Pa., president; J. L. Green, Laclede-Christy Clay Products Company, St. Louis, Mo., vice-president; C. C. Edmunds, McLain Fire Brick Company, Pittsburgh, treasurer; F. W. Donahoe, 840 Oliver Building, Pittsburgh, the association's executive

offices, secretary; E. M. Durant of the Pacific Clay Products Company, Los Angeles; Frank J. Helwig of the Standard Fire Brick Company, Pueblo, Col., and C. E. Kapitzky of the Federal Refractories Company, Cleveland, were elected to the executive committee.

Since its formation eight years ago the association has had for its aim in the serving of its client industries the closest co-operation possible in order to standardize as far as possible on existing molds, sizes and types. This has resulted in the elimination of many proposed special types of refractories for so-called special purposes, with consequently lower production costs.

St. Louis as an Electrical Manufacturing City

That advertising of the electrical industry is reacting up to a still higher plane is evidenced by the efforts of the St. Louis Electrical Board of Trade and the St. Louis Chamber of Commerce in working up a two-page article on "St. Louis—the Electrical Center" in the March issue of *Greater St. Louis*.

Estimates show that this city gives employment to between 8,000 and 10,000 persons in the electrical industry, while there is $50,000,000 invested in the various electrical factories. There is hardly an important line of electrical apparatus or supplies that is not made in St. Louis, according to the report.

Master Electric's Capital Trebled in First Year

Since its formation a year ago with a capitalization of $50,000, the Master Electric Company, 460 Beacon Street, Dayton, Ohio, has increased its capitalization from $100,000 to $150,000 by a recent addition. This new money is being used as increased working capital and to take care of the company's rapidly growing business, according to recent advices. Much of this business is with appliance manufacturers. E. P. Larsch is president; S. A. Brown is treasurer; R. S. Shonk is treasurer. On March 1 F. O. Kirkpatrick came to the company as vice-president and sales manager.

Canadian G. E.'s New Officers and 1920 Report

At the annual meeting of the Canadian General Electric Company, Ltd., held in Toronto on March 21, Frederic Nicholls, in retiring as president and general manager to assume the chairmanship of the board of directors, said that the outlook for the electrical industry was most promising as the demand for hydro-electric energy was greatly in excess of the supply. A survey of Canada's water power shows nearly 20,000,000 hp. available, of which only 2,000,000 hp. had been utilized. A. E. Dyment was elected president and J. J. Ashworth was promoted to be general manager, John A. Bremner, heretofore controller, was promoted to be assistant general manager, and Stephen Haas was appointed vice-president in place of Mr. Dyment.

From the annual report net profits for 1920 amounted to $1,356,689, an increase over the amount submitted for the year 1919. The original capital of the company was $10,000 when Senator Nicholls originated the syndicate thirty-three years ago; the assets have since grown to $31,000,000.

Fire Will Not Handicap Austin Machinery Corporation

The fire in the Winthrop Harbor (Ill.) plant of the Austin Machinery Corporation on March 22, while extensive at this plant, will not, according to officials of the corporation, in any way interfere with production and prompt delivery of Austin construction machines, as practically all lines of Austin machinery are also being built at the plants at Muskegon, Mich., as well as at the former plant of the Toledo Bridge & Crane Company at Toledo, Ohio. President B. A. Linderman immediately arranged for the plants at Toledo and Muskegon to increase their stock production orders to take care of the shortage which would otherwise occur through the loss of the Winthrop Harbor plant.

Insulators to Be Manufactured in France

The Compagnie Générale d'Electro-Ceramique, which is one of the largest manufacturers of electrical porcelain in France, has completed arrangements with the Jeffery-Dewitt Insulator Company covering the manufacture of the J-D high-tension insulator in France.

The insulators manufactured by the French company will be sold in France, Spain, Portugal, Italy and Belgium. A new factory for the manufacture of these insulators will be erected at Tarbes, where the same type and quality of insulator will be made as are made in the home factory at Kenova, W. Va.

A Dressler tunnel kiln is being erected, and it is stated that large orders have already been placed by some of the French railway companies, which have started an extensive program of electrification. A. L. McLeod, vice-president of the Jeffery-Dewitt Insulator Company, has just returned from Europe, where he signed the contract mentioned above. He returned very enthusiastic over the prospects of business to be done.

Westinghouse Expands Service in California

The Westinghouse Electric & Manufacturing Company has recently purchased at Emeryville, across the bay from San Francisco, a twelve-acre tract of ground upon which it expects shortly to erect buildings that will give increased advantages and space to its San Francisco service shop and warehouse. Additional buildings to provide facilities for assembling and testing electrical machinery for use on the coast will be erected also, it is announced. Plans for the first group of buildings will comprise about 120,000 sq.ft. of floor space. This move to increase the company's service on the Coast is the outcome of a recent visit of officials of the company to review conditions there in the electrical industry and prospects for the future.

The Habirshaw Electric Cable Company, 10 East Forty-third Street, New York City, has filed notice of increase in capital stock from $31,500,000 to $33,000,000.

The Downing Electrical Company, Des Moines, Iowa, has made arrangements with the Emerson Electric Manufacturing Company, St. Louis, whereby it will distribute the Emerson fans in the central Iowa territory.

D. B. Wilson announces that he is with Wilson & Ensign, 1405 Real Estate Trust Building, Philadelphia, and has no connection with Harris & Evans, as was stated in these columns on March 5. Wilson & Ensign, district managers, represents the Wellman-Seaver-Morgan Company, Benjamin Engineering Company, Irwin Manufacturing Company, Superior Die Castings Company and the Cleveland Electric Motor Company.

The Page Steel & Wire Company has transferred its general sales offices from the Union Arcade Building, Pittsburgh, to 1054 Grand Central Terminal, New York City. District sales offices will be maintained in the cities where they are now located; in Pittsburgh, 644 Union Arcade Building: Cleveland, 817 Guardian Building; Chicago, 208 South La Salle Street, and in Adrian, Mich., at the company's plant.

The Baraboo Manufacturing Company, Baraboo, Wis., manufacturer of electrically operated refrigerating units, has increased its capital stock by a new issue of $50,000 of preferred stock.

The Hugro Manufacturing Company, Warsaw, Ind., manufacturer of vacuum cleaners and washing machines, has appointed the George McKeever Company, 189 East Long Street, Columbus, Ohio, district managers for central Ohio for its "Airplane" cleaners and washing machines.

Laughlin & Barney, dealers in machine tools and agents in the Pittsburgh district for the Champion Engineering Company, Kenton, Ohio, manufacturer ol electric traveling cranes, will remove from their present quarters in the Wabash Building April 1 to rooms 481-487 Union Arcade, Pittsburgh.

J. E. Haetten & Company, Inc., 299 Broadway, New York City, have recently been organized by J. E. Haetten and J. V. Schmidt, formerly of the sales department of F. H. Niles & Company, New York City, to conduct a new and second-hand machinery business. The company will specialize in machine tools and power equipment.

The Valley Electric Company, 3157 South Kingshighway, St. Louis, manufacturer of alternating-current motors and battery chargers, has opened a sales office in the Bush Terminal Sales Building, 130 West Forty-Second Street, New York City, in charge of C. A. Sticht, district manager.

The Blaw-Knox Company, Blawnox (Pittsburgh), Pa, has recently established a district sales office in Birmingham, Ala., and on April 1 will open a new sales territory in the Southwest, with headquarters in Kansas City, Mo. The Kansas City office, which is in the Interstate Building, is in charge of R. B. Randall, formerly connected with the company's Chicago office, who will be known as the manager of the Southwestern territory.

The Crane Company, 836 South Michigan Avenue, Chicago, has recently established offices in the following places: Scott Building, Erie, Pa., in charge of Earl Colton; 16 Carroll Street, Madison, Wis., in charge of W. J. Pick; 57 Eddy Street, Providence, R. I., in charge of Arthur L. Hinman, and Miners Bank Building, Wilkes-Barre, Pa., in charge of C. H. Bossard.

The Duplex Electric Company, 258 Broadway, New York City, has filed notice of increase in capital stock from $100,000 to $125,000.

Foreign Trade Notes

THE AUTOMATIC & ELECTRIC FURNACES, LTD., 281 Gray's Inn Road, London, W. C. 1, England, announces that the Wild-Barfield patent rights for Germany, Poland and the former Austria-Hungary have been purchased by the C. Lorenz Aktiengesellschaft, and that the latter company has placed an order for various parts to complete about 100 furnaces.

THE CRANE COMPANY, 836 South Michigan Avenue, Chicago, has recently established an office in the Oliver Building, Sherbrooke, Quebec, in charge of Charles La Prairie. The company has also opened an office in the Central Building, Victoria, B. C., Canada, in charge of R. W. Murdoch.

INTERNATIONAL INDUSTRIAL FAIR IN HOLLAND.—The managers of the International Industries Fair to be held at Utrecht, Holland, from Sept. 6 to 16, 1921, have issued a booklet giving details regarding same. Further information may be obtained from L. Wittert van Hoogland, secretary the Netherlands Chamber of Commerce, 44 Beaver Street, New York City.

ELECTRIC EQUIPMENT FOR STEEL MILL IN SOUTH AFRICA.—The South Africa Iron & Steel Corporation, Ltd., has announced plans for the erection of a new steel plant, to include electrically driven steel rolling mills, steel furnaces and coke ovens, with equipment for the recovery of tar, sulphate of ammonia and benzol, and probably with electric furnaces. The cost is estimated at £2,200,000.

EXTENSION OF ELECTRICAL SERVICE IN BOHEMIA.—The electric generating capacity of the East Bohemian electric power house at Trutnov (Trautenau), according to Trade Commissioner Geringer of Prague, is being increased from 4,500 kw. to 10,000 kw. At present the plant is furnishing electricity to six towns, about ninety communities and a hundred factories of northeastern Bohemia, and the proposed extension will provide for supplying energy within a radius of more than 30 km. from Trutnov. Hydro-electric plants will supply part of the additional energy. The cost of the proposed undertaking is estimated at 35,000,000 crowns. Government aid is being given to the project.

T. H. WATSON & COMPANY, Ltd., Sheffield, England, and the ELECTRIC FURNACE CONSTRUCTION COMPANY, Philadelphia, announce that arrangements have been made with the General Combustion Company of Canada, Ltd., New Birks Building, Montreal, to handle, build and sell their various electric smelting, melting and refining furnaces in Canada. The Canadian rights of the Greaves-Etchells type of furnace are also included in the arrangements made. The American company will also co-operate with the Canadian company on the supply and installation of the various types of electrically heated core and mold drying ovens, annealing and heat-treating furnaces, and on electric furnace problems in general.

VICTORIA, AUSTRALIA, ASKS TENDERS ON STEEL POLES AND COPPER CABLE.—Tenders are invited by the State Electricity Commission of Victoria, Australia, for 600 steel poles for carrying three three-phase, 22,000-volt feeder cables and two metallic return telephone circuits, and for 250 miles of hard-drawn copper cable for the Morwell power scheme. Copies of specification No. 47, covering the steel poles, and specifications No. 66, covering the copper cable, have been forwarded by A. W. Ferrin, trade commissioner, and have been placed on sale at the Bureau of Foreign and Domestic Commerce, district offices, 734 Custom House, New York City, and 1424 First National Bank Building, Chicago. Tenders must be received at the office of the Electricity Commission, Melbourne, Australia, on May 31, 1921.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An American commercial agent who has sales and office connections in France (No. 34,592) is in the United States and desires to be placed in communication with firms with a view to securing an agency for the sale of electrical supplies, lamps, cables, etc.

An inquiry has been received by a consul in Rumania (No. 34,562) for descriptive literature and catalogs for orders on a commission basis of light switches, light brackets, etc., suitable for large apartment houses.

An inquirer in Rumania (No. 34,573) desires to purchase hot-air engines for small water plants or lighting for houses.

A mercantile firm in England (No. 34,588) desires to purchase and secure an agency for electric vehicles, particularly 1,500-lb., 1-ton-type delivery vans, and electric battery charging equipment.

A firm of commission agents dealing in machinery in Canada (No. 34,598) desires to obtain an agency for the sale of electric lighting plants for farms, milling and elevating machinery, etc.

New Apparatus and Publications

RIVET HEATER.—The General Electric Company, Schenectady, N. Y., has recently developed a new type of rivet heater, suitable for work in shipyards, building construction, structural steel work, etc.

METAL STATISTICS.—The fourteenth annual edition of the Metal Statistics, 1921, has been published by the American Metal Market and Daily Iron and Steel Report, 81 Fulton Street, New York City.

BRUSH HOLDERS.—D. B. Flower, 1217 Spring Garden Street, Philadelphia, is distributing two leaflets covering different types of Flower brush holders for industrial motors.

SERIES LIGHTING CUT-OUT. — The General Electric Company, Schenectady, N. Y., has recently developed a new automatic cut-out in series incandescent street lighting.

DAMPER REGULATOR.—A new hydraulically operated damper regulator for boiler pressure up to 250 lb. has recently been developed by the Atlas Valve Company, 282 South Street, Newark, N. J.

CONVEYOR.—Publication 2,000 issued by the Cutler-Hammer Manufacturing Company, Milwaukee, describes the "C-H" dispatch conveyor, which is designed particularly for newspaper and magazine publishing plants.

HEATING DEVICES. — The Electric Heating & Manufacturing Company, Seattle, Wash., is distributing a booklet describing the Apfel's "Heet-feet" heating apparatus and other electrical heating devices.

CONNECTORS AND TESTING CLIPS. —The Frankel Connector Company, Inc., 177-179 Hudson Street, New York City, is distributing a catalog covering its solderless electrical connectors, testing clips, etc.

STORAGE BATTERY PARTS.—The W. F. Battery Supply Company, 1618 North Broad Street, Philadelphia, has issued a new catalog covering its products, entitled "Everything in 'Storage Battery Parts and Shop Equipment' for Manufacturers and Service Stations."

AUTOMATIC STARTERS.—Leaflet 1660-A, distributed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes its type F automatic starters for squirrel-cage induction motors.

REGENERATIVE COMPRESSOR.—Bulletin No. 350 issued by the Griscom-Russell Company, 90 West Street, New York City, describes the G-R regenerative compressor.

CIRCUIT BREAKER. — The Automatic Reclosing Circuit Breaker Company, Columbus, Ohio, is distributing bulletin No. 312, covering its automatic reclosing breaker.

GENERATORS, MOTOR-GENERATORS AND DYNAMOTORS.—The Electric Specialty Company, Stamford, Conn., has issued bulletin No. 231, covering its high-voltage generators, motor-generators and dynamotors, designed especially for radio work ranging in capacity from 20 to 1,500 watts, and from 350 to 2,200 volts.

PULVERIZED COAL. — The Fuller-Lehigh Company, Fullerton, Pa., is distributing bulletin No. 600, entitled "Pulverized Coal for Boilers."

New Companies

THE SANFORD ELECTRIC CORPORATION, Belleville, N. J., has been incorporated by George C. Sturdy, J. Blake Kellogg and Lester C. Burdett, 71 Rutgers Street. The company is capitalized at $250,000 and proposes to manufacture electrical appliances and equipment.

THE IVAR-LITE COMPANY, INC., Boston, has been incorporated with a capital stock of $250,000 to manufacture electric lighting equipment and other electrical apparatus. The incorporators are G. Ivar Johnson, Robert G. E. Willson and Herbert E. Pheeney, 8 Brewster Terrace, Brookline, Mass.

THE WASHERETTE CORPORATION, Rochester, N. Y., has been incorporated by J. J. and T. R. Finucane and H. P. Sickels, Rochester. The company is capitalized at $200,000 and proposes to manufacture electrically operated washing machines and parts.

THE UNIVERSITY BATTERY & ELECTRIC COMPANY, Enid, Okla., has been incorporated by G. E. Darland, C. P. Harris and I. F. Conkling, Enid. The company is capitalized at $100,000 and proposes to manufacture electric storage batteries and other electrical equipment.

THE GENERAL INDUSTRIAL X-RAY COMPANY, Milwaukee, Wis., has been incorporated by E. H. Karrer, 246 West Water Street, William Guilliaume and Otto Herman. The company is capitalized at $100,000 and proposes to manufacture medical equipment.

GREENWICH ELECTRIC COMPANY, Hamburg, Pa., has been organized with a capital stock of $5,000 to operate a light and power system in Hamburg. H. H. Shollenberger is treasurer.

THE EVANSPORT LIGHT & POWER COMPANY, Evansport, Ohio, has been organized to furnish light and power service in Evansport and Stryker.

THE LAMBERT LIGHT & POWER COMPANY, Grundy, Va., has been incorporated with a capital stock of $10,000 by J. W. Lambert, president, and J. E. Lambert, secretary.

THE ROMNEY POWER COMPANY, Romney, W. Va., has been incorporated with a capital stock of $25,000 by James O. and E. H. Blue and J. W. Shull.

Record of Electrical Patents

Notes on United States Patents

(Issued March 8, 1921)

1,370,971. LIGHT PROJECTOR; Lyman C. Josephs, Jr., United States Army. App. filed June 6, 1919. Military and naval searchlight.

1,370,987. APPARATUS FOR ELECTRICALLY WELDING PLATES; Thomas E. Murray, Jr., Brooklyn, N. Y. Spot-welding plates of large area.

1,370,989. ELECTRIC FURNACE; Ralph D. Nye, Canton, Ohio. App. filed July 9, 1920. Means for disconnecting the current conductor.

1,370,992. TYPEWRITER; Alfred B. Parker, Monroe, La. App. filed Nov. 28, 1919. Automatic carriage return.

1,371,000. PUFF IRON; Benjamin Schindler and Jacob G. Viertle, Freeport, N. Y. App. filed April 24, 1919. Heads of different sizes and shapes readily substituted.

1,371,010. X-RAY SYSTEM; Harry F. Waite, New York, N. Y. App. filed Jan. 17, 1920. Single transformer used for either of two X-ray generating tubes.

1,371,023. IMPULSE STARTER; James McC. Edwards, Cedar Heights, Ia. App. filed Jan. 21, 1920. For automobile magnete.

1,371,049. ADJUSTABLE RESISTANCE UNIT; Benjamin F. Oler, Woodbury Heights, N. J. App. filed Sept. 28, 1918. Sliding contact inside coil.

1,371,061. CONDENSER; Clarence D. Tuska, Hartford, Conn. App. filed March 29, 1919. Variable, for wireless work.

1,371,092. BATTERY-SEALING MEANS; Walter E. Holland and James M. Skinner, Philadelphia, Pa. App. filed July 8, 1919. Threaded rubber sleeve around terminal post.

1,371,093. BATTERY CONNECTION; Walter E. Holland and James M. Skinner, Philadelphia, Pa. App. filed July 8, 1919. An insulated conductor and terminal connection.

1,371,094. MEANS FOR ELECTRIC ARC WELDING, CUTTING AND THE LIKE; Claud J. Holslag, South Orange, N. J. App. filed Nov. 16, 1920. Two or more series-connected arcs.

1,371,114. SPARK INTENSIFIER; Ralph L. Proesch, Beaver Dam, Wis. App. filed Feb. 9, 1920. Auxiliary gap.

1,371,164. SELF-WINDING CLOCK; Fritz Guye, Neuchatel, Switzerland. App. filed April 25, 1919. Wound by electric motor.

1,371,192. RHEOSTAT; Edward M. Bentley, Lawrence, N. J. App. filed Aug. 7, 1919. Flexible metallic ribbon bending over a curved contact surface.

(Issued March 15, 1921)

1,371,228. REDUCTION OF STATIC INTERFERENCE IN RADIO RECEIVING STATIONS; Austen M. Curtis, Brooklyn, N. Y. App. filed Oct. 8, 1917. Wave filter.

1,371,233. ROTOR FOR SQUIRREL-CAGE INDUCTION MOTORS AND METHOD OF SECURING THE WINDING THERETO. Joens E. Fries, Birmingham, Ala. App. filed Aug. 21, 1918. No screws or other mechanical joints. End rings formed by spot-welding several duplicates of punchings of rotor.

1,371,287. RHEOSTAT AND PROCESS OF MAKING THE SAME; Charles Wirt, Philadelphia, Pa. App. filed March 23, 1918. Extremely compact.

1,371,298. TELEPHONE AND CALL SIGNAL SYSTEM; Alva B. Clark, Brooklyn, N. Y. App. filed Sept. 20, 1918. Circuit efficient for transmitting currents of ringing or talking frequency.

1,371,299. APPARATUS FOR EFFECTING EXOTHERMIC CHEMICAL SYNTHESES AT HIGH TEMPERATURE AND PRESSURE; Georges Claude, Paris, France. App. filed Feb. 2, 1920.

1,371,301. COMBINED FEEDER AND MAGNETIC SEPARATOR; Henry Converse, Winona, Miss. App. filed Aug. 21, 1920. For use with cottonseed, grain or similar material.

1,371,310. TRAILING-CABLE FUSE AND HANDLE; Joseph F. Joy, Pittsburgh, Pa. App. filed June 19, 1920. For mining machinery.

1,371,367. WINDING MACHINE; William Grunow, New York, N. Y. App. filed Feb. 23, 1918. For forming wire coils.

1,371,378. OIL-TESTING APPARATUS; Laurence M. Klauber, San Diego, Cal. App. filed July 25, 1919. To test oil without removing it from case of transformer, oil switch, etc.

1,371,404. HIGH-POTENTIAL ELECTRIC MACHINE; Reinhold H. Wappler, Yonkers, N. Y. App. filed June 26, 1918. Composite type.

1,371,414. NICKEL PLATING; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed June 17, 1919.

1,371,420. PORTABLE ELECTRIC ARC LIGHT; Edward Hirt, Weymouth, Mass. App. filed Jan. 2, 1917. Carried in one hand.

1,371,466. ELECTROLYTE; Alvin A. Breitenwischer and George A. Howland, Detroit, Mich. App. filed April 30, 1920. Capable of hardening when allowed to set.

1,371,471. METHOD AND APPARATUS FOR DUPLEX CABLE SIGNALING; Louis Cohen, Washington, D. C. App. filed May 27, 1919. Overland lines or cables.

1,371,507. X-RAY STAND AND TABLE; William Meyer, Chicago, Ill. App. filed April 12, 1918.

1,371,523. CIRCUIT INTERRUPTER; Joseph Slepian, Pittsburgh, Pa. App. filed Sept. 7, 1917. For quickly de-energizing holding electromagnet.

1,371,558. SYSTEM OF CONTROL; Arthur J. Hall, Wilkinsburg, Pa. App. filed March 13, 1916. Electric railway motors.

1,371,559. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed July 5, 1917. For preventing slippage of wheels of locomotive during accelerating or regenerative period.

1,371,560. RELAY; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 28, 1917. Low-voltage tripping devices for polyphase motor circuits.

1,371,561. CIRCUIT-INTERRUPTING DEVICE; Henry D. James, Edgewood Park, Pa. App. filed Sept. 1, 1917. Low-voltage tripping device.

1,371,566. CONTROL SYSTEM; Paul L. Mardis and Lynn G. Riley, Wilkinsburg, Pa. App. filed July 12, 1917. Electric railway vehicles.

1,371,567. RADIO RECEIVING SYSTEM; Robert H. Marriott, Bremerton, Wash. App. filed Dec. 26, 1916. Means for treating distributing electric forces.

1,371,603. SYSTEM OF CONTROL; John A. Clarke, Jr., and Samuel B. Schenck, Wilkinsburg, Pa. App. filed Nov. 5, 1915. Electric railway vehicle.

1,371,620. COMMUTATING MEANS FOR DYNAMO-ELECTRIC MACHINES; Floyd T. Hague, Pittsburgh, Pa. App. filed Aug. 7, 1916.

1,371,647. ARMATURE-WINDING DEVICE; Henry K. Sandell, Chicago, Ill. App. filed March 18, 1920. For holding and revolving armature.

1,371,661. STORAGE-BATTERY GRID; Edward F. Andreae, Newark, N. J. App. filed May 29, 1918. Pasted-type plate.

1,371,698. PROCESS OF AND APPARATUS FOR ELECTROLYSIS; Oscar Linder, Chicago, Ill. App. filed Jan. 11, 1918. For completely eliminating salts and other ionized chemicals.

1,371,699. PROCESS FOR THE PURIFICATION OF POROUS OR GELATINOUS MATERIALS; Oscar Linder, Chicago, Ill. App. filed Jan. 11, 1918. Eliminating and recovering metallic salts, acids and other chemicals.

1,371,717. TELEPHONE SYSTEM; Ray S. Wilbur, Lyndhurst, N. J. App. filed Dec. 28, 1918. Transmission of frequencies outside the designed range.

1,371,728. SUBMARINE SOUND DETECTOR; Theodore Bodde, Lynn, Mass. App. filed Sept. 2, 1916. For detecting sounds emitted under water.

1,371,737. TELEPHONE EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 11, 1919. Alternating current for operating switch.

1,371,746. ELECTRIC STORAGE BATTERY; Charles J. V. Fery, Paris, France. App. filed March 24, 1919. Capable of replacing dry batteries.

1,371,747. TELEPHONE STAND; Charles Fischer, New York, N. Y. App. filed May 20, 1919. For holding receiver to ear.

1,371,748. HIGH-CAPACITY SELECTIVE SIGNALING SYSTEM; Joseph C. Field, Orange, N. J. App. filed June 24, 1911. Step-by-step selective devices.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MIDDLEBURY, VT. — The Hortonia Power Company, Brandon, contemplates rebuilding its power plant at Middlebury, which was recently destroyed by fire, causing a loss of about $40,000.

FRAMINGHAM, MASS. — Considerable electrical equipment will be installed in the four-story extension to be built at the plant of the Dennison Manufacturing Company, manufacturer of paper products.

HOLYOKE, MASS.—The Lyman Mills have awarded a contract to the Swan Rigging Company, 145 State Street, Springfield, for the installation of a 2,500-kw. turbo-generator and auxiliary operating equipment in the power plant at their local cotton mills.

NATICK, MASS.—Electrical equipment will be installed in the three-story shoe manufacturing plant to be constructed by C. W. Dean & Company, North Main Street, at an estimated cost of $100,000.

SPRINGFIELD, MASS. — The United Electric Light Company has awarded a contract to the Adams & Buxton Construction Company for the installation of underground conduits in Liberty and Carew Streets, Page Boulevard and neighboring thoroughfares, about 300,000 duct feet.

PROVIDENCE, R. I.—Application will soon be made by the Penal and Charitable Commission to the General Assembly for an appropriation of $80,000 for the installation of electric light and power equipment at the state prison.

NEW HAVEN, CONN.—Plans have been filed by the United Electric Illuminating Company, 84 Temple Street, for the construction of a 70-ft. x 90-ft. addition to its steam power plant on Grand Avenue, to cost about $40,000.

Middle Atlantic States

BUFFALO, N. Y.—The Standard Milling Company 49 Wall Street, New York City, plans to erect a flour mill at the foot of Louisiana Street, Buffalo, to cost about $9,000,000. The installation as proposed will require about 16,000 hp. and will be furnished by one of the local electric companies. A. E. Baxter Engineering Company, Ellicott Square, is engineer.

ILION, N. Y.—Plans are under way for the installation of an ornamental street-lighting system in the business district.

JAMESTOWN, N. Y. — The Board of Water and Lighting Commissioners, it is reported, has received bids for the construction of an addition to the municipal electric power plant on Steele Street.

NEW YORK, N. Y.—Electrically operated hoisting and conveying machinery, loading and unloading equipment, etc., will be installed in the new seven-story freight terminal to be erected by the Pouch Terminal Company, 17 State Street, New York City, at Clifton, S. I. A similar building will also be built by the American Dry Dock Company, 17 State Street, New York City, an affiliated organization, at Tompkinsville, S. I. The structures will be 120 ft. x 160 ft. Contracts for the construction of the buildings have been awarded to the Turner Construction Company, 242 Madison Avenue, New York City.

BUTLER, N. J. — Arrangements have been made by the City Council for the installation of a switchboard and accessory equipment at the municipal electric power plant.

NEWARK, N. J.—Plans are under way for a number of improvements and extensions to the street-lighting system in different parts of the city. It is proposed to remove the arc lamps now used on Broad Street and substitute modern fixtures. Market Street will also be provided with new fixtures. Harry R. Jackson, electrical engineer has been engaged to make a survey and estimate of cost.

PERTH AMBOY, N. J.—The Board of Aldermen has authorized City Purchasing Agent Martin Olsen to award contracts for equipment for the ornamental lighting system on Madison Avenue.

ROOSEVELT, N. J. — Negotiations are under way between the Borough Council and the Public Service Company for a new lighting contract providing for a number of improvements to its system as well as a new commercial service to the East Rahway district.

ALTOONA, PA. — The Penn Central Light & Power Company has applied to the Public Service Commission for permission to issue $625,000 in bonds for proposed extension, improvements, etc.

HARRISBURG, PA. — The Harrisburg Light & Power Company has applied to the Public Service Commission for permission to issue $33,000 in bonds for extensions and betterments to its system.

HARRISBURG, PA. — The Harrisburg Pipe Bending Company plans to install new equipment at its power house, including stokers, boilers and auxiliary apparatus.

BALTIMORE, MD. — The Public Improvement Commission is planning extensions to the municipal electrical conduit system to cost about $1,000,000.

GLENBURNIE, MD.—The Public Service Commission has approved a franchise granted to Grover C. Morgan for the installation and operation of a light and power system in Glenburnie.

NORFOLK, VA.—Extensions and improvements are contemplated to the municipal waterworks system, to cost about $700,000. Considerable electrical equipment will be required.

PORTSMOUTH, VA.—Plans are under way for the construction of additions to the electric pumping plant connected with the waterworks system. George J. Jervey, Municipal Building, is city manager.

WASHINGTON, D. C.—Bids will be received at the office f the District Commissioners, room 509, District Building, Washington, D. C., until April 8 for electric lighting, power nd telephone conduits and wiring in the psychopathic branch of the Gallinger Municipal Hospital, on Reservation No. 13, Massachusetts Avenue and Twenty-first Street, Southeast. Proposal blanks, plans and specifications may be obtained from the Chief Clerk, Engineer Department, room 427, District Building.

North Central States

GRAND RAPIDS, MICH.—The Creston Improvement Association has appointed a committee to make investigations relative to installing a boulevard lighting system in Creston from the east end of the Leonard Street bridge to Plainfield Avenue, then north on Plainfield Avenue to the Plainfield School. Ole Henderson is chairman.

DAYTON, OHIO.—The Dayton Power & Light Company, it is reported, will furnish power for the operation of the Dayton & Western Traction Company, Dayton, after July 1. To provide for the change in service, a substation will be constructed at West Alexandria and units will be installed for the conversion of the 33,000 volts, 60-cycle, to 660 volts direct current. Changes will be made at Stop 8, 6 miles from the city, including the installation of new equipment.

GIRARD, OHIO.—Improvements to the street-lighting system are under consideration. John L. Gleason is village clerk.

HARRODSBURG, KY.—The City Council will receive bids shortly for the construction of a municipal electric power plant to be operated in connection with the waterworks system, to cost about $100,000. Pearce Greeley, 36 West Adams Street, Chicago, Ill., is engineer.

FORT WAYNE, IND.—The installation of a central fire-alarm system, to cost about $40,000, is contemplated. For further information address the Board of Safety.

HAMMOND, IND. — Plans have been prepared by W. F. Bridge, engineer, for a boulevard lighting system. A. J. Swanson is chairman.

ARENZVILLE, ILL.—Petition has been filed by the Arenzville Light & Power Company for permission to erect and maintain an electric transmission line from the city limits of Jacksonville to Concord, Arenzville and Chapin.

JOHNSTON, ILL.—The Central Illinois Public Service Company, Mattoon, has closed a contract to supply power to a mine near Johnston City.

WISCONSIN RAPIDS, WIS.—The Electric Light and Water Commission is considering the erection of a substation in the eastern part of the city.

DES MOINES, IOWA.—Plans are being prepared for the construction of a new electrically operated pumping plant, to cost about $150,000. Bids, it is understood, will be asked for in about sixty days. Alvord & Burdick, 1418-20 South Dearborn Street, Chicago, are engineers.

JOPLIN, MO.—The Union Iron Works, 623 Kentucky Avenue, contemplates improvements to its plant, including the installation of new machinery and the construction of a power house, 20 ft. x 40 ft.

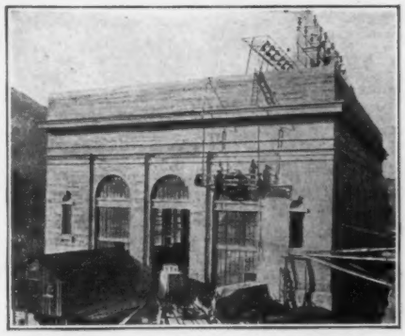
KANSAS CITY, MO. — The Western Tablet Company contemplates the erection of a new power house, 40 ft. x 100 ft., at its factory at Eleventh and Mitchell Streets, to cost about $35,000.

SPRINGFIELD, MO.—The erection of an electric line from the city limits to Sunshine School is planned by the Springfield Gas & Electric Company.

Southern States

WINSTON-SALEM, N. C.—The question of issuing $750,000 in bonds to enlarge the lighting and water systems and provide for service to the schools is under consideration.

ATLANTA, GA.—Electrical and mechanical equipment will be installed in connection with extensions and improvements to the waterworks system, for which $2,250,000 in bonds have been approved.



KERN RIVER NO. 3 NEARING COMPLETION

This 32,000-kw. plant of the Southern California Edison Company will use the highest head turbines built and operate on either 50 or 60 cycles.

APALACHICOLA, FLA.—The City Council contemplates taking over the electric plant of the Apalachicola Electric Light & Telephone Company and rebuilding it in connection with the waterworks plant, for which $50,000 in bonds have been voted. H. B. Adcock is superintendent of the electric plant. J. H. Cook is Mayor.

BARTOW, FLA.—The Board of Trade is considering the installation of an ornamental lighting system on the principal business streets of the city.

FORT PIERCE, FLA. — Bonds to the amount of $60,000 have been voted for improvements to the electric light and power plant.

PALMETTO, FLA.—The Palmetto Crate Company, recently organized with a capital of $100,000, plans to establish a steam-driven power plant in connection with its new factory. Considerable transmission machinery will be installed at the works. C. E. Gibbens is secretary and treasurer.

DOTHAN, ALA.—Bonds to the amount of $750,000 have been voted for a hydro-electric plant on the Choctawatchee River to develop about 20,000 hp. R. W. Lisenby is city clerk.

BRISTOW, OKLA.—The Oklahoma Gas & Electric Company, it is reported, plans to make improvements to the lighting system to cost about $30,000.

MANITOU, OKLA.—Bonds to the amount of $10,000 have been voted for the construction of an electric light plant.

Pacific and Mountain States

TACOMA, WASH.—Surveys have been completed for the proposed Lake Cushman-Tacoma transmission line from this city to the Mason County line near Allyn. Plans provide for a high-tension line, 6,000 ft. long, to span the Narrows; that across Henderson Bay will be in two cables, 1,200 ft. long, with a central tower to be erected at Wauna, and the line across North Bay will be 2,800 ft. long.

IRWINDALE, CAL.—The construction of a substation in Irwindale is being contemplated by the Southern California Edison Company.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Corporation has applied for permission to erect a transformer station at 420 West Tenth Street.

LOS ANGELES, CAL. — Marcus Pluth, 424 Wilcox Building, has applied to the Federal Power Commission to build two diversion dams in the north and south forks of the Whitewater river, a power house, 9 miles of transmission line, etc.

MERCED, CAL.—The installation of an ornamental street-lighting system in the business district is under consideration. The plans call for forty electroliers.

ORLAND, CAL.—Plans and specifications for street paving, conduits for electrolier wires, etc., were adopted by the Town Trustees.

PUENTE, CAL.—The Southern California Edison Company plans to erect a 60,000-volt transmission line from the Puente substation through Covina Valley.

RED BLUFF, CAL.—A preliminary report has been submitted to the City Trustee by W. F. Lunning, city engineer, regarding the cost of establishing a municipal electric light plant, which is estimated at about $169,000.

RICHMOND, CAL.—The City Council has entered into a five-year contract with the Western States Gas & Electric Company providing for the installation of an electrolier lighting system on MacDonald, Washington, Richmond and Standard Avenues.

SAN FRANCISCO, CAL.—The California Oregon Power Company, recently reorganized, has taken over the properties of the California-Oregon Power Company and has been authorized by the Railroad Commission to issue $1,849,000 in certificates later to be exchanged for bonds. Of the proceeds $932,650 will be used for construction purposes.

SAN FRANCISCO, CAL.—The El Dorado Power Company, care of Chickering & Gregory, Merchants' Exchange Building, has applied to the Federal Power Commission for preliminary permit to erect a power house, transmission line, enlarge three reservoirs, construct two reservoirs, etc., in the counties of El Dorado, Alpine and Amador.

VALLEJO, CAL.—Plans are being prepared by T. D. Kilkenny, city engineer, for the construction of the proposed Gordon Valley Dam, including an electrically operated pumping plant of a 3,000,000-gal. daily capacity, etc.

PROVO, UTAH—The Salt Lake & Utah Railroad Company, 222 South West Temple Street, Salt Lake City, contemplates the construction of a new substation at Curtis, 5 miles from Provo, to cost about $50,000.

TWIN FALLS, IDAHO. — The Idaho Power Company has applied to the Federal Power Commission for permission to develop a hydro-electric power project at Twin Falls on the Snake River.

PRESCOTT, ARIZ.—The City Council is considering the installation of an ornamental street-lighting system in the paving district.

Canada

PARRY SOUND, ONT. — The municipal power plant and the wing dam has been damaged by recent floods. George Murray is superintendent.

PETERBORO, ONT.—The Canadian General Electric Company, 212 King Street, West, Toronto, it is reported, is receiving bids for the construction of a power house in Peterboro.

CALGARY, ALTA.—The provincial government is having plans prepared for the construction of a power plant to cost about $150,000.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill. Annual convention, Buffalo, N. Y., May 9-11.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Atlantic City, N. J., April 21-23.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 W. 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio. Annual convention, Washington, April 23.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, S. E. Dillon, Hot Springs, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto. Annual convention, Toronto, June 28.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 522 5th Ave., New York City.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill. Annual convention, Hot Springs, Va., May 25-27.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Rochester, N. Y., Sept. 26-29.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo. Annual convention, Kansas City, Mo., April 21-23.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ASSOCIATION OF RAILWAY AND UTILITY COMMISSIONERS. Secretary, James B. Walker, Public Service Commission of the State of New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City. Annual convention, Chicago, May 31-June 3.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis. Annual convention, Duluth, Minn., June 14-16.

NORTHWEST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, July 12-15.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal. Annual meeting, Del Monte, Cal., May 25, 26 and 27.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC RELATIONS SECTION, N. E. L. A. Chairman, J. E. Davidson, Omaha, Neb.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, A. C. Cornell, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, Guaranty Building, 522 5th Ave., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN GEOGRAPHIC DIVISION N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

SOUTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex. Annual convention, Galveston, Tex., May 18-21.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

TECHNICAL SECTION, N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.